Forest and Woodland Habitat Types (Plant Associations) of Arizona South of the Mogollon Rim and Southwestern New Mexico

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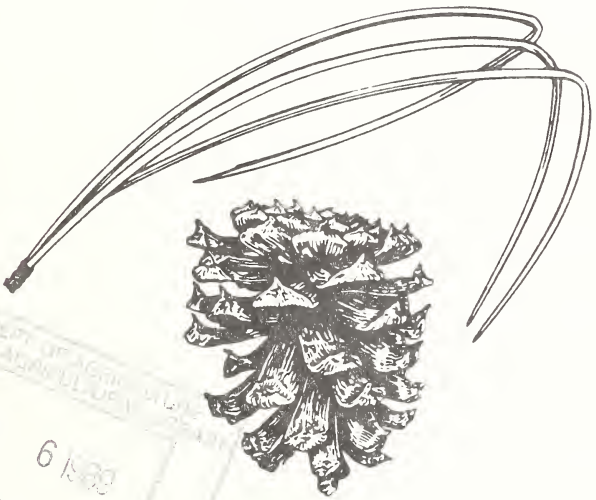
Edition 2



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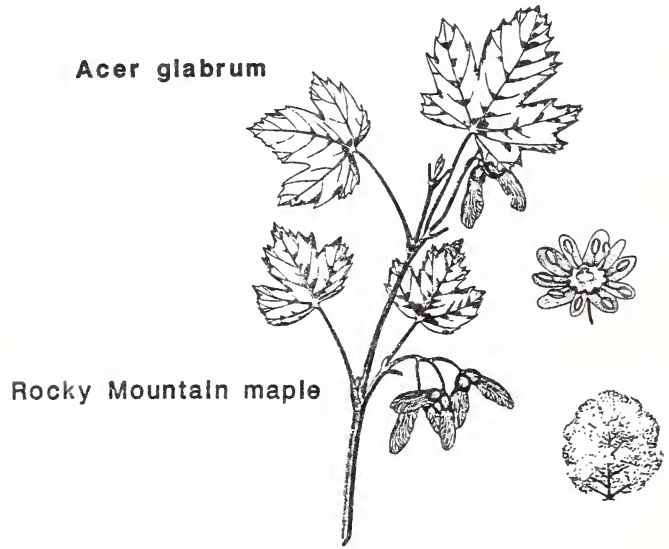
This material was prepared by Dick Bassett, Milo Larson, and Will Moir from habitat type training courses given May 12-16, 1986 and July 13-16, 1987. Materials for those courses were edition 1. In this edition Reggie Fletcher helped prepare botany materials. Keys and descriptions to the habitat types were revised with help from Suraj Ahuja, Esteban Muldavin, and Maurice Williams.

The primary information for forest habitat types is a computer printout dated February 1987 prepared by Esteban Muldavin. Data consisted of 317 forest plots (Muldavin et al 1986ab). For sampling and classification procedures see Moir and Ludwig (1983).

The primary information for woodlands are reconnaissance field notes, published literature, and summary data from various Terrestrial Ecosystem Survey (TES) reports. For relationships between TES and habitat type classification see Moir and Carleton (1987).

GEOGRAPHIC NOTE

This guide covers central and southern Arizona south of the Mogollon Rim and extreme southwestern New Mexico (Hidalgo and Grant Counties). Adjoining areas are covered in USFS 1986a (see references).



Using the Key and Descriptions

The key works best in stands from late successional to near climax stages. Stands in early to mid-seral stages generally will not key directly to their association. In young or recently disturbed stands the association must be inferred from site factors, indicator species, tree successional relationships, or from known successional stages. Fortunately, climax can usually be inferred from the most shade tolerant tree species that is successfully reproducing. The difficulty of young or mid-seral stands can also be minimized by finding the most mature stand on a similar site in the local landscape and applying the key to that stand.

To use the key, determine the combination of potential climax tree species by noting especially the proportions of trees in young, regenerating sizes. This helps identify the climax series, using the first of the keys below. The following keys are based on forest and woodland series. In these keys it is necessary to identify certain understory shrubs and herbs (key species) and to note their canopy coverage. Coverage classes are defined by the adjectives and nouns below.

Proceed through the key making careful observations required at each decision couplet. For difficult decisions go both ways. Validate the determination against the description which fits your observations best. Check your observations if descriptions do not agree. No stand will fit the description perfectly.

KEY ADJECTIVES AND NOUNS

ABSENT - cannot be found in stand (opp = present)
ACCIDENTAL - individuals very infrequent, occasional, or limited to special microsites.
ABUNDANT - canopy coverage > 25%.
COMMON - canopy coverage > 1% (opp = scarce).
DOMINANT - Density or cover is as great as, or greater than, any other species of the same life form (two or more species can be dominant, i.e. codominant).
LUXURIANT - canopy coverage > 50%.
POORLY REPRESENTED - canopy coverage < 5% (opp = well represented).
PRESENT - individuals can be found in the stand (opp = absent).
REGENERATION - understory trees as established seedlings, saplings, or small poles (dbh < 10 in.).
SCARCE - canopy coverage < 1% (opp = common).
WELL REPRESENTED - canopy coverage > 5% (opp = poorly represented).

Keys to Forests and Woodlands

1. Populus fremontii (broadleafed cottonwood), Platanus wrightii (sycamore), Populus angustifolia (narrowleafed cottonwood), Alnus oblongifolia (Arizona alder), or other riparian obligate trees along streams ...9
1. Trees in other environments without riparian obligate plants...2

2. Trees on talus or debris slopes with fragmental soils (gravels and cobbles are more than 90% soil volume)----------SCREE FORESTS (USFS 1986a)
2. Trees in other environments...3

3. High elevation coniferous forests with non-accidental regeneration by Picea engelmannii (Engelman spruce), Abies lasiocarpa (corkbark fir), Abies concolor (white fir), Picea pungens (blue spruce), or Pseudotsuga menziesii (Douglas-fir)----------KEY A
3. Forests or woodlands with the above species absent or accidental... 4

4. Forests with Pinus ponderosa (ponderosa pine), Pinus arizonica (Arizona yellow pine), Pinus leiophylla (Chihuahua pine), or Pinus engelmannii (Apache pine)----------KEY B
4. Woodlands with Pinus (pinyons), Quercus (oaks), Juniperus (junipers), or Cupressus arizonica (Arizona cypress) but not the above species... 5

5. Woodlands on slopes >40% and rocky or bouldery soils interrupted by rock outcrop, rocky ledges, or bare rock----------SCARP WOODLAND (1W)
5. Woodlands of other environments ...6

6. Cupressus arizonica (Arizona cypress) present and not accidental...7
6. Cupressus arizonica absent or accidental...8.

7. Quercus hypoleucoides (silverleaf oak) common----------CUAR/QUHY (37W)
7. Quercus hypoleucoides absent or scarce----------CUAR/QUTU (38W)

8. Evergreen oaks are well represented or abundant in tallest stratum---------KEY C
8. Evergreen oaks are poorly represented in tallest stratum----------KEY D

9. Populus angustifolia (narrowleafed cottonwood) well represented---POAN series (39)
9. Populus angustifolia poorly represented ...10

10. Essentially coniferous forest (Populus tremuloides, aspen) may be present---
----POAN series (39)
10. Forest not strictly coniferous ...11

11. Alnus oblongifolia (Arizona alder) common----------POAN series (39)
11. Alnus oblongifolia absent or scarce ...12

12. Platanus wrightii (sycamore) common----------PLTR series (41)
12. Platanus writhtii scarce or absent----------POFR series (40)

13. Quercus gambelii (Gambel oak) well represented----------ABCO/QUGA (13)
13. Quercus gambelii absent or poorly represented ...14

14. Maples (Acer spp.) common ...15
14. Maples scarce or absent ...17.

15. Herbs luxuriant----------ABCO/EREX (11)
15. Herbs not luxuriant ...16

16. Acer grandidentatum (big toothed maple) common----------ABCO/ACGR (8)
16. Acer grandidentatum usually absent----------ABCO/ACGL (7)

17. Muhlenbergia virescens (screwleaf muhly) common----------ABCO/MUVI (12)
17. Muhlenbergia virescens scarce or absent ...18

18. Carex foenea (fony sedge) often abundant or luxuriant--------ABCO/CAFO (10)
18. Carex foenea scarce to well represented----------ABCO/EREX (11)

19. Acer grandidentatum (big toothed maple) common----------PSME/ACGR (17)
19. Acer grandidentatum scarce or absent ...20

20. Oaks (Quercus spp) well represented ...22
20. Oaks poorly represented ...21

21. Muhlenbergia virescens (screw leaf muhly) well represented---PSME/MUVI (19)
21. Muhlenbergia virescens poorly represented----------PSME/BRCI (18)

22. Quercus gambelii (Gambel oak) well represented----------PSME/QUGA (21)
22. Quercus gambelii poorly repepresented ...23

23. Quercus hypoleucoides (silverleaf oak) common----------PSME/QUHY (22)
23. Quercus hypoleucoides scarce or absent----------PSME/QUAR (20)

KEY A: Abies lasiocarpa, Picea engelmannii, Picea pungens, Abies concolor, Pseudotsuga menziesii Series. (Spruce-Fir and mixed conifer forests)

1. High elevation forests containing Picea engelmannii (Engelman) spruce) or Abies lasiocarpa var arizonica (corkbark fir) ...2
1. Forests with the above trees absent or accidental ...8

2. Abies lasiocarpa absent ...3
2. Abies lasiocarpa present ...4

3. Herbs scarce----------ABLA/MOSS (4)
3. Herbs at least common; Chiricahua Mts.----------PIEN/ACGL (6)

4. Herbs scarce----------ABLA/MOSS (4)
4. Herbs at least common ...5

5. Vaccinium myrtillus (huckleberry) well represented----------ABLA/VAMY (5)
5. Vacciuium myrtillus poorly represented ...6

6. Carex foenea (fony sedge) abundant or luxuriant----------ABLA/CAFO (1)
6. Carex foenea absent to well represented ...7

7. Herbs abundant or luxuriant----------ABLA/EREX (2)
7. Herbs well represented; Santa Catalina Mts----------ABLA/JAAM (3)

8. Picea pungens (blue spruce) reproducing, not accidental ...9
8. Picea pungens absent or accidental ...11

9. Pinus ponderosa (ponderosa pine) absent or accidental-------PIPU/EREX (16)
9. Pinus ponderosa common ...10

10. Festuca arizonica (Arizona fescue) well represented---------PIPU/FEAR (14)
10. Festuca arizonica poorly represented----------PIPU/CAFO (15)

11. Abies concolor (white fir) reproducing, not accidental ...12
11. Abies concolor absent or accidental ...19

12. Herbs scarce----------ABCO/BERE (9)
12. Herbs at least common ...13

13. Quercus gambelii (Gambel oak) well represented----------ABCO/QUGA (13)
13. Quercus gambelii absent or poorly represented ...14

14. Maples (Acer spp.) common ...15
14. Maples scarce or absent ...17.

15. Herbs luxuriant----------ABCO/EREX (11)
15. Herbs not luxuriant ...16

16. Acer grandidentatum (big toothed maple) common----------ABCO/ACGR (8)
16. Acer grandidentatum usually absent----------ABCO/ACGL (7)

17. Muhlenbergia virescens (screwleaf muhly) common----------ABCO/MUVI (12)
17. Muhlenbergia virescens scarce or absent ...18

18. Carex foenea (fony sedge) often abundant or luxuriant--------ABCO/CAFO (10)
18. Carex foenea scarce to well represented----------ABCO/EREX (11)

19. Acer grandidentatum (big toothed maple) common----------PSME/ACGR (17)
19. Acer grandidentatum scarce or absent ...20

20. Oaks (Quercus spp) well represented ...22
20. Oaks poorly represented ...21

21. Muhlenbergia virescens (screw leaf muhly) well represented---PSME/MUVI (19)
21. Muhlenbergia virescens poorly represented----------PSME/BRCI (18)

22. Quercus gambelii (Gambel oak) well represented----------PSME/QUGA (21)
22. Quercus gambelii poorly repepresented ...23

23. Quercus hypoleucoides (silverleaf oak) common----------PSME/QUHY (22)
23. Quercus hypoleucoides scarce or absent----------PSME/QUAR (20)

KEY B: Pinus ponderosa (includes P. arizonica), Pinus engelmannii, and Pinus leiophylla Series. (Ponderosa pine forests, Madrean pine-oak woodlands and forests).

1. Pinus leiophylla (Chihuahua pine) or Pinus engelmannii (Apache pine) climax, not accidental ...2
1. Above pines absent or accidental ...5

2. Pinus engelmannii (Apache pine) present----------PINEN/QUHY (38)
2. Pinus engelmannii absent ...3

3. Piptochaetium fimbriatum (pinyon ricegrass) mostly well represented or abundant----------PILE/PIFI (23)
3. Piptochaetium fimbriatum usually poorly represented ...4

4. Quercus hypoleucoides (silverleaf oak) is the leading oak----PILE/QUHY (25)
4. Quercus hypoleucoides is minor among other oaks----------PILE/QUAR (24)

5. Juglans major (Walnut) or Vitis arizonica (Canyon grape) common---
----------PIPO/JUMA (29)
5. Above species scarce or absent ...6

6. Exposed bedrock over most of area----------PIPO/ROCKLAND (37)
6. Other environments ...7

7. Essentially herbaceous understories, often grassy ...8
7. Shrubs well represented to luxuriant; Oaks (Quercus spp) well represented ...12

8. Bouteloua gracilis (blue grama) usually well represented (if poorly represented, then pinyon pines or alligator junipers are common) ...9
8. Bouteloua gracilis absent or scarce ...10

9. Muhlenbergia montana (mountain muhly) well represented-------PIPO/MUMO (30)
9. Muhlenbergia montana poorly represented----------PIPO/BOGR (27)

10. Muhlenbergia virescens (screwleaf muhly) common to abundant--PIPO/MUVI (31)
10. Muhlenbergia virescens scarce or absent ...11

11. Poa pratensis (Kentucky bluegrass) well represented to abundant----------PIPO/FEAR (28)
11. Poa pratensis poorly represented or absent ...12

12. Quercus gambelii (Gambel oak) well represented as either tree or shrub----------PIPO/QUGA (34)
12. Quercus gambelii poorly represented or absent ...13

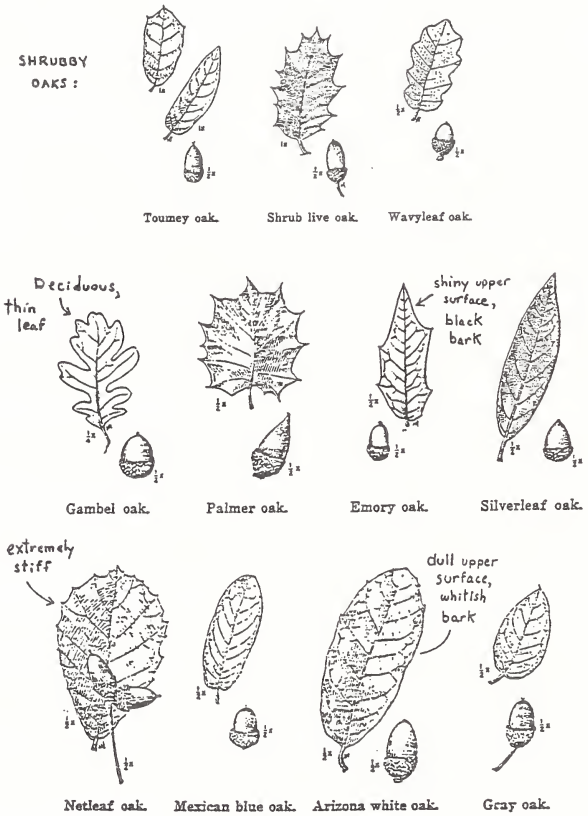
13. Species of Arctostaphylos (manzanita) usually abundant-------PIPO/ARPU (26)
13. Species of Arctostaphylos not abundant ...14

14. Quercus hypoleucoides (silverleaf oak) well represented------PIPO/QUHY (35)
14. Quercus hypoleucoides poorly represented or absent ...15

15. Quercus emoryi (Emory oak) well represented, especially
    along drainages with granitic soils----------PIPO/QUEM (33)
    PIPO/QUEM
15. Quercus emoryi poorly represented or environments otherwise... 16

16. Quercus rugosa (netleaf oak) absent or scarce ...17
16. Quercus rugosa well represented or abundant----------PIPO/QURU (36)

17. Muhlenbergia montana (mountain muhly) well represented-------PIPO/MUMO (30)
17. Muhlenbergia montana poorly represented or absent-----------PIPO/QUAR (32)



15. Quercus emoryi (Emory oak) well represented, especially along drainages with granitic soils----------PIPO/QUEM (33)
15. Quercus emoryi poorly represented or environments otherwise... 16

16. Quercus rugosa (netleaf oak) absent or scarce ...17
16. Quercus rugosa well represented or abundant----------PIPO/QURU (36)

17. Muhlenbergia montana (mountain muhly) well represented-------PIPO/MUMO (30)
17. Muhlenbergia montana poorly represented or absent----------PIPO/QUAR (32)

KEY C: Quercus grisea, Quercus oblongifolia, Quercus emoryi, Quercus arizonica, Quercus hypoleucoides Series (Madrean oak woodlands, Encinal)

1. Quercus oblongifolia (Mexican blue oak) common ...2
1. Quercus oblongifolia absent or scarce ...3

2. Savannas of gentle slopes or deep, alluvial soils-------QUOB/BOUTELOUA (2W)
2. Savannas usually of moderate or steep, colluvia slopes-------QUOB/DAWH (3W)

3. Quercus grisea (Gray oak) well represented (see also 14) ...4
3. Quercus grisea poorly represented or absent ...5

4. Essentially grassy understory----------QUGR/BOCU (4W)
4. Essentially shrubby understory (chaparral woodland)----------QUGR/CEMO (5W)

5. Quercus emoryi (Emory oak) well represented ...6
5. Quercus emoryi poorly represented or absent ...12

6. Tall (>30 ft) Quercus emoryi on dry terraces along drainages-QUEM/JUMA (9W)
6. Shorter trees in other environments ...7

7. Generally open woodlands with grassy understories (savannas) ...8
7. Closed woodlands or woodlands with shrubby understories ...9

8. Savannas on mostly alluvial soils----------QUEM/BOCU (7W)
8. Savannas mostly of moderate or steep colluvial slopes--------QUEM/DAWH (8W)

9. Shrubs common or well represented ...12
9. Shrubs abundant or luxuriant ...10

10. Arctostaphylos pungens (manzanita) common to abundant--------QUEM/ARPU (6W)
10. Arctostaphylos pungens scarce or absent ...11

11. Quercus turbinella (shrub live oak) well represented---------PIFA/QUTU (23W)
11. Quercus turbinella poorly represented----------PIED(PIFA)/CEMO (25W)

12. Quercus hypoleucoides (silverleaf oak) well represented ...13
12. Quercus hypoleucoides poorly represented ...14

13. Muhlenbergia longiligula (long tongue muhly) usually common; mature oaks are trees----------QUHY/MULO (13W)
13. Muhlenbergia longiligula scarce; mature oaks shrubby---------PIDI/QUHY (18W)

14. Grasses poorly represented----------QUAR/RHTR (12W)
14. Grasses well represented to abundant ...15

15. Savannas on mostly alluvial soils ...16
15. Savannas mostly of moderate or steep colluvial slopes--------QUAR/MUEM (10W)

16. Juniperus osteosperma (Utah juniper) well represented--------PIFA/BOGR (21W)
16. Juniperus osteosperma poorly represented or absent----------QUAR/PIFI (11W)

KEY D: Pinus discolor, Pinus fallax, Pinus edulis, and Juniperus Series
(Madrean pine-oak and Pinyon-Juniper woodlands)

1. Species of Pinus reproducing successfully, not accidental ...2
1. Pines (Pinus spp.) absent or accidental; junipers well represented ...
... **Juniperus Series** ...16

2. Herbs scarce; shrubs scarce or common ...3
2. Both herbs and shrubs at least common ...4

3. Soils clearly erosional (dissected by active rills and gullies)-------
---- **PIED(PIFA)(PIDI)/Sparse** (27W)
3. Soils not actively rilled or gullied (sheet erosion may be occurring)----
----------PIFA/YUBA (24W)

4. Chrysothamnus nauseosus (rabbitbrush) or Fallugia paradoxa (Apache plume) common to abudant along washes----------PIED(PIFA)/CHNA-FAPA (26W)
4. Not as above ...5

5. Grassy woodlands (shrubs scarce to well represented) ...6
5. Shrubs well represented to abundant, and grasses usually poorly represented ...9

6. Pinus discolor (border pinyon) common to well represented ...7
6. Pinus fallax (Arizona pinyon) or P. edulis (Rocky Mt. pinyon) common to well represented ...8.

7. Colluvial soils often of moderate or steep slopes----------PIDI/MUEM (15W)
7. Alluvial soils of valleys or gentle lower slopes----------PIDI/PIFI (16W)

8. Cowania stansburiana (cliffrose) scarce----------PIFA/BOGR (21W)
8. Cowania stansburiana at least common----------PIFA/BOGR, COST phase (21W)

9. Canotia holacantha (crucifixion thorn) present----------PIFA/CAHO (22W)
9. Canotia holacantha absent ...10

10. Cercocarpus spp (mountain mahogany) well represented ...11
10. Cercocarpus poorly represented ...12

11. Pinus edulis (Rocky Mountain pinyon) well represented-------PIED/CEMO (25W)
11. Pinus discolor (border pinyon) well represented ----------PIDI/RHCO (19W)

12. Oaks (Quercus) well represented to abundant in understory ...13
12. Oaks (as understory) poorly represented or absent----------PIDI/CHAR (14W)

13. Quercus toumeyi (Toumey oak) or its hybrids present---------PIDI/QUTO (17W)
13. Quercus toumeyi or its hybrids absent ...14

14. Arctostaphylos pungens (manzanita) scarce or absent---------PIFA/QUTU (23W)
14. Arctostaphylos pungens at least common ...15

15. Pinus fallax (Arizona pinyon) well represented----------PIFA/ARPU (20W)
15. Pinus edulis (Rocky Mt pinyon) or P. discolor (border pinyon) or mixtures of these pinyons well represented------PIED(PIDI)/ARPU (20W)

JUNIPERUS SERIES

16. Perennial herbs scarce, soils with high erosion------JUOS-JUMO/SPARSE (32W)
16. Perennial herbs common or soils otherwise ...17

17. Juniperus osteosperma (Utah juniper) dominant or codominant with J. erythrocarpa or J. monosperma ("stringy-bark" junipers) ...18
17. Other junipers dominant ...20

18. Hilaria mutica (tobosa) well represented (sometimes Hilaria belangeri (curly mesquite) is well represented or abundant)-----JUOS/HIMU (33W)
18. Hilaria mutica poorly represented or absent ...19

19. Cowania stansburiana (cliffrose) poorly represented---------JUOS/BOGR (31W)
19. Cowania stansburiana well represented----------JUOS/BOGR, COST phase (31W)

20. Juniperus deppeana (alligator juniper) dominant ...21
20. Juniperus deppeana secondary to other junipers or absent ...22

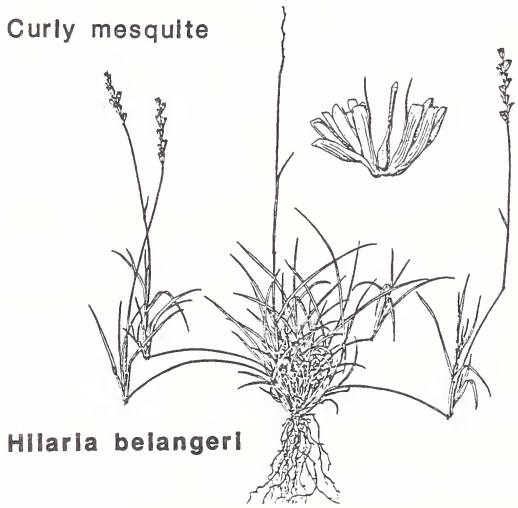
21. Understory shrubs abundant----------JUDE/ARPU (29W)
21. Understory shrubs scarce or common----------JUDE/BOGR (30W)

22. Quercus turbinella (shrub live oak) abundant-----JUER/QUTU, QUTU phase (36W)
22. Quercus turbinella not abundant ...23

23. Canotia holacantha (crucifixion thorn) present----------JUER/CAHO (35W)
23. Canotia holacantha absent ...24

24. Prosopis velutina (mesquite) absent or scarce ...25
24. Prosopis velutina at least common----------JUER/QUTU, PRVE phase (36W)

25. Juniperus monosperma (one-seed juniper) well represented; sw NM and adjoining AZ----------JUMO/BOCU, NOMI phase (34W)
25. Juniperus erythrocarpa (red berry juniper) well represented; central and se AZ----------JUER/QUTU, BOGR phase (36W)



JUNIPERUS SERIES

16. Perennial herbs scarce, soils with high erosion------**JUOS-JUMO/SPARSE** (32W)
16. Perennial herbs common or soils otherwise ...17

17. Juniperus osteosperma (Utah juniper) dominant or codominant with J. erythrocarpa or J. monosperma ("stringy-bark" junipers) ...18
17. Other junipers dominant ...20

18. Hilaria mutica (tobosa) well represented (sometimes Hilaria belangeri (curly mesquite) is well represented or abundant)-----**JUOS/HIMU** (33W)
18. Hilaria mutica poorly represented or absent ...19

19. Cowania stansburiana (cliffrose) poorly represented---------**JUOS/BOGR** (31W)
19. Cowania stansburiana well represented----------**JUOS/BOGR, COST phase** (31W)

20. Juniperus deppeana (alligator juniper) dominant ...21
20. Juniperus deppeana secondary to other junipers or absent ...22

21. Understory shrubs abundant----------**JUDE/ARPU** (29W)
21. Understory shrubs scarce or common----------**JUDE/BOGR** (30W)

22. Quercus turbinella (shrub live oak) abundant-----**JUER/QUTU, QUTU phase** (36W)
22. Quercus turbinella not abundant ...23

23. Canotia holacantha (crucifixion thorn) present----------**JUER/CAHO** (35W)
23. Canotia holacantha absent ...24

24. Prosopis velutina (mesquite) absent or scarce ...25
24. Prosopis velutina at least common----------**JUER/QUTU, PRVE phase** (36W)

25. Juniperus monosperma (one-seed juniper) well represented; sw NM and adjoining AZ----------**JUMO/BOCU, NOMI phase** (34W)
25. Juniperus erythrocarpa (red berry juniper) well represented; central and se AZ----------**JUER/QUTU, BOGR phase** (36W)

Format of the Descriptions

DESCRIPTIONS OF EACH PLANT ASSOCIATION (HABITAT TYPE) ARE ARRANGED IN THE FOLLOWING SEQUENCE:

NAME - BOTANIC, COMMON, AND CODE NAMES ARE GIVEN.

CODE - THIS IS A NUMBER FOR ASSOCIATIONS AND PHASES AS USED IN AUTOMATED TIMBER STAND FILES.

SYN - SYNONOMY, OR OTHER NAMES FOR THE ASSOCIATION OR HABITAT TYPE APPEARING IN PUBLISHED LITERATURE.

SITE - GENERAL ENVIRONMENTAL FEATURES OF THE PLANT ASSOCIATION; MAP = MEAN ANNUAL PRECIPITATION. THE RANGE OF SOILS IS GIVEN IN VARIOUS TES REPORTS.

TES - LIFE ZONES AND ELEVATIONAL SUBZONES ALONG A CLIMATIC GRADIENT FROM INFORMATION IN THE TERRESTRIAL ECOSYSTEM SURVEY (TES). CODING IS AS FOLLOWS:

CODE	LIFEZONE	CODE	ELEVATIONAL SUBZONE
4	Woodlands	-1	warm, dry
5	Ponderosa pine	0	typical or modal
6	Mixed conifer	+1	cool, wet
7	Subalpine forest		

CLIMATES ARE CODED AS FOLLOWS: **HSC** - HIGH SUN COLD, **LSC** - LOW SUN COLD, **HSM** - HIGH SUN MILD, **LSM** - LOW SUN MILD. CONSULT TES HANDBOOK FOR DETAILED DESCRIPTIONS OF THESE CLIMATES.

TREES - TREES ARE CODED AS FOLLOWS: ABLA = Abies lasiocarpa, PIEN = Picea engelmannii, PIPU = Picea pungens, POTR = Populus tremuloides, POAN = Populus angustifolia, ABCO = Abies concolor, PSME = Pseudotsuga menziesii, PIDI = Pinus discolor, PIED = Pinus edulis, PIFA = Pinus fallax, PIST = Pinus strobiformis, PIPO = Pinus ponderosa, PILE = Pinus leiophylla, PLTR = Platanus wrightii, QUAR = Quercus arizonica, QUEM = Quercus emoryi, QUGA = Quercus gambelii, QUGR = Quercus grisea, QUHY = Quercus hypoleucoides, JUER = Juniperus erythrocarpa, JUDE = Juniperus deppeana, JUMO = Juniperus monosperma, JUOS = Juniperus osteosperma.

Note: For separation between Juniperus monosperma and J. erythrocarpa see Fletcher (1985). Also, Quercus arizonica and Q. grisea can be hard to separate in certain areas.

TREE SUCCESSIONAL STATUS IS GIVEN AS FOLLOWS:

CODE	STATUS	CONCEPT
C	Major Climax	Species is clearly regenerating successfully and surviving to maturity in late and advanced stages of succession. The species is also present in all (or nearly all stands).
c	Minor Climax	As above except species may not occur in all (or most) stands.
S	Major Seral	Species is clearly regenerating successfully and surviving only in early or middle stages of succession, although mature trees often persist as overstory in later stages. The species is present or potential in all (or nearly all) stands.
s	Minor Seral	As above except species may not occur (now or as potential) in all (or most) stands.
a	Acci-dental	The species occurs (either as seral or climax associate) only on special microsites or very infrequently. It will not become more abundant as succession progresses.
	Blank	Species is not found in typical stands.

SHRUBS, HERBS, CRYPTOGAMS. CRYPTOGAMS ARE USUALLY THE MOSSES AND LICHENS CONSIDERED COLLECTIVELY. AN EXPRESSION OF COVERAGE IS FOLLOWED BY LISTING SOME OF THE MORE FREQUENTLY ENCOUNTERED PLANTS. COVERAGE VALUES ARE AS FOLLOWS:

Luxuriant = coverage > 50%, **Abundant** = 25-50%, **Well represented** = 5-25%, **Poorly represented** = < 5%, **Common** = 1-5%, **Scarce** = < 1%.

Percentages are relative to the entire area of a plot or stand.

Diagnostic species are indicated by *.

DIS - DISTRIBUTION OR GEOGRAPHIC RANGE. STATE ABBREVIATIONS ARE: AZ = ARIZONA, NM = NEW MEXICO, CO = COLORADO, UT = UTAH, ID = IDAHO. LOCATIONAL ADJECTIVES INCLUDE s = SOUTHERN, c = CENTRAL, n = NORTHERN, sw = SOUTHWESTERN, ETC. ADMINISTRATIVE ABBREVIATIONS INCLUDE NF = NATIONAL FOREST, RD = RANGER DISTRICT, RES = INDIAN RESERVATION.

ALSO SEE - REFERENCE IS GIVEN TO SIMILAR OR CLOSELY RELATED ASSOCIATIONS.

Format of the Management Implications

H. T. - COMMON NAME OF THE HABITAT TYPE

REGENERATION METHODS - THE GENERAL RECOMMENDATIONS MAY BE MODIFIED BY CONDITIONS OF SOIL OR TOPOGRAPHY.

PLANTING - THE PROBABILITY OF PLANTING SUCCESS IS A SUBJECTIVE ESTIMATE OF PROBABILITY OF ACHIEVING 80% OR HIGHER SURVIVAL OF WELL-PLANTED, HEALTHY SEEDLINGS ON ADEQUATELY PREPARED SITE. FOR SOIL LIMITATIONS TO PLANTING, SEE TES REPORTS.

SITE PREPARATION CODES ARE:

B = USUALLY BENEFICIAL FOR PLANTED CONIFERS,
H = USUALLY DETRIMENTAL TO CHANCES FOR SURVIVAL OF PLANTED OR NATURALLY SEEDED CONIFERS,
A = STRONGLY FAVORS NATURAL REGENERATION OF ASPEN.

FOR SOIL LIMITATIONS ON SITE PREPARATION, SEE TES REPORTS.

REVEGETATION IS A SUBJECTIVE ESTIMATE OF RATE OF REVEGETATION AFTER CLEARING OR CATASTROPHIC DISTURBANCE. FOR EROSION OR SOIL LOSS INDICES, SEE TES REPORTS. SOIL SPECIFIC REFORESTATION POTENTIALS ARE ALSO GIVEN IN TES REPORTS.

STOCKABILITY IS AN ESTIMATE OF THE ABILITY OF THE HABITAT TYPE TO SUPPORT FULL STOCKING OF COMMERCIAL TIMBER SPECIES EXPRESSED AS A DECIMAL FRACTION.

BUDWORM SUSCEPTABILITY IS AN INDEX VALUE FOR USE IN THE WESTERN SPRUCE BUDWORM HAZARD RATING FORMULA.

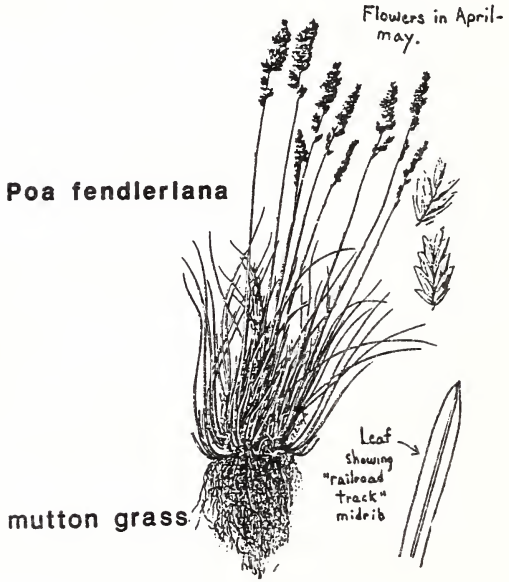
TSI - TIMBER STAND IMPROVEMENT

PRODUCTIVITY TREES ARE ESTIMATED FROM LIMITED SITE INDEX DATA AND CLASSIFIED BY CUBIC FEET/ACRE/YEAR AS HIGH, MODERATE, AND LOW. SITE INDEX IS AN AVERAGE FOR THE SPECIES NOTED PLUS OR MINUS ONE STANDARD DEVIATION. N = NUMBER OF SITE TREES INCLUDED IN THE INDEX. FOR SITE INDEX BY SOIL TYPES, SEE TES REPORTS. MORE DATA IS NEEDED FOR MOST HABITAT TYPES.

FORAGE RATING VALUE FOR CATTLE ARE GIVEN FOR CLEARINGS (EARLY SERAL) AND FOR MATURE FOREST STANDS (LATE SERAL). FOR FORESTS THE RATINGS ARE:

HIGH	> 1500 lbs/acre/yr (average)
MODERATE	500-1500 lbs/ac./yr
LOW	250-500 lbs/ac./yr
NONE	< 250 lbs/ac./yr

FORAGE AND FORAGE MAXIMUM RATINGS FOR SPECIFIC SOILS ARE CONTAINED IN TES REPORTS.



FORESTS

Pinus ponderosa/Muhlenbergia virescens

31

Abies lasiocarpa/Carex foenea

Corkbark fir/Fony sedge
ABLA/CAFO

003370

SYN: Picea engelmannii/Carex foenea (Moir and Ludwig 1979).

SITE: South facing slopes and ridgetops, borders of cienegas; >10,000 ft.

TES: 7, 0 LSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUSC	JUDE	QUGA	QUHY
c	C		s		s							

SHRUBS: Scarce.

HERBS: Abundant or luxuriant on turf soils; patchy or discontinuous where soil is broken by surficial scree. Carex foenea, Poa fendleriana, Carex rossii, Muhlenbergia montana, Bromus ciliatus, Helenium hoopsii, Senecio wootoni, Geranium richardsonii, Potentilla albiflora.

DIS: Pinaleno (Graham) Mts., AZ

ALSO SEE: Intergrades to ABLA/VAMY and ABLA/MOSS on gentle slopes.

COMMENTS: Mid-seral closed pole stands of this h.t. can resemble ABLA/Moss with scarce understory. Clearings are strongly dominated by graminoid turf.

Abies lasiocarpa/Erigeron eximius

Corkbark fir/Forest fleabane 003080
ABLA/EREX

SYN: Abies lasiocarpa/Erigeron superbus (Moir and Ludwig 1979), ABLA-PIEN1/EREX (Johnston 1984).

SITE: All slopes and aspects 9,400-10,200 ft.; n-slopes as low as 8,900 ft. MAP 29-31 in/yr.; deep winter snowpack.

TES: 7, -1.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PISI	PIPO	PIED	JUSC	JUDE	QUGA	QUHY
C	C	s	S	s	S	s	a					

SHRUBS: Poorly or well represented. Rubus parviflorus, Salix scouleriana, Acer glabrum, Ribes pinetorum, Jamesia americana, Holodiscus dumosus, Symphoricarpos oreophilus.

HERBS: Luxuriant. Erigeron eximius*, Geranium richardsonii, Smilacina stellata, Osmorhiza depauperata, Artemisia franserioides, Ramischia secunda, Viola canadensis, Bromus ciliatus, Trisetum montanum, Carex foenea, Poa pratensis.

CRYPTOGAMS: Well represented.

DIS: sw-NM into s-CO; local s of Rim (Pinaleno Mts, Fort Apache), more extensive in White Mts, AZ and isolated locations n of the Mogollon Rim.

ALSO SEE: ABLA/LAAR, PIEN/EREX, and ABLA/ACGL (Alexander et al 1987, Youngblood and Mauk 1985), the latter on sites with shrubs well represented.

COMMENTS:

H. T.: Corkbark fir/Forest fleabane

REGENERATION METHODS:

Clearcut: Favors aspen; favors spruce over fir.

Shelterwood: Heavy shelter favors fir, less shelter favors spruce.

Seed Tree: Not usually successful due to blowdown.

Selection: Favors fir over spruce and aspen.

PLANTING:

Recommended Species: Engelmann spruce, Douglas-fir, corkbark fir.

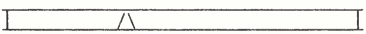
Success Probability: High

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	H	B	B
Burning	H,A	H,A	

REVEGETATION: Rapid

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.5

TSI: Can be used to improve species composition.

PRODUCTIVITY: 20  100

Site Index $\underset{\text{PSME}}{82 + ?}$ $\underset{\text{PIEN}}{64 + 16}$ _____ N = 89

Resource Value Rating (Cattle): Early Seral H Late Seral M-L

OTHER: Good potential for aspen management; important for snow retention.

Abies lasiocarpa/Jamesia americana

Corkbark fir/Waxflower 003320
ABLA/JAAM

SYN:

SITE: north-facing slopes above 8,700 ft.; MAP 33-34 in/yr, MAST 40-41 F. Moderate winter snowpack.

TES: 7,-1 LSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUSC	JUDE	QUGA	QUHY
C			S	S	S							

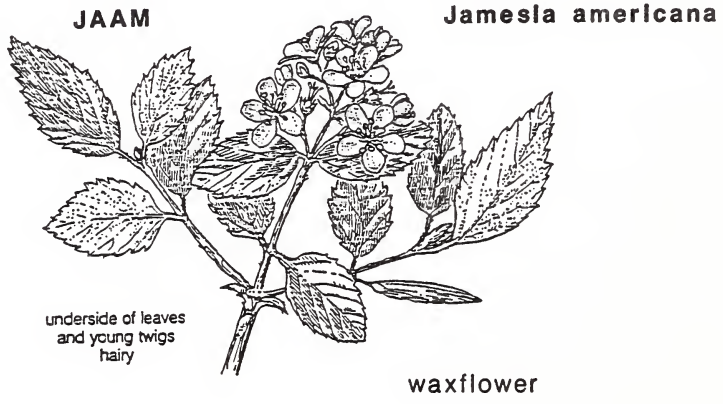
SHRUBS: Common. Jamesia americana, Ribes pinetorum, Rubus strigosus, Symphoricarpos oreophilus, Sambucus melanocarpa.

HERBS: Well represented, often in patches. Viola canadensis, Actaea rubra, Disporum trachycarpum, Cystopteris fragilis, Ramischia secunda, secunda, Bromus ciliatus, Festuca sororia, Pteridium aquilinum, Vicia americana.

DIS: Mount Lemmon in Santa Catalina Mts, AZ.

ALSO SEE: Niering and Lowe (1984).

COMMENTS: A unique, insular habitat in a desert region.



Corkbark fir/Waxflower 003320
ABLA/JAAM

SYN:

SITE: north-facing slopes above 8,700 ft.; MAP 33-34 in/yr, MAST 40-41 F. Moderate winter snowpack.

TES: 7,-1 LSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUSC	JUDE	QUGA	QUHY
C			S	S	S							

SHRUBS: Common. Jamesia americana, Ribes pinetorum, Rubus strigosus, Symphoricarpos oreophilus, Sambucus melanocarpa.

HERBS: Well represented, often in patches. Viola canadensis, Actaea rubra, Disporum trachycarpum, Cystopteris fragilis, Ramischia secunda, secunda, Bromus ciliatus, Festuca sororia, Pteridium aquilinum, Vicia americana.

DIS: Mount Lemmon in Santa Catalina Mts, AZ.

ALSO SEE: Niering and Lowe (1984).

COMMENTS: A unique, insular habitat in a desert region.

Abies lasiocarpa/Moss

Corkbark (subalpine) fir/Moss
ABLA/MOSS

ABLA phase 003110
PIEN phase 003111
PSME phase 003112

SYN: Abies lasiocarpa-Picea engelmannii/Moss (Johnston 1984).

SITE: Summits, ridgetops, upper slopes 9,800-11,500 ft.; cold, dry sites.

TES: 7, 0 (ABLA and PIEN phases), 7, -1 (PSME phase), LSC

TREES:	ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUSC	JUDE	QUGA	QUHY
Abies lasiocarpa phase	C	c		s									
Picea engelmanni phase	c	C		s		s	a						
Pseudotsuga menziesii phase	c	C		s	S	S	s	a					

SHRUBS: Scarce to common. Ribes montigenum, Vaccinium myrtillus, Acer glabrum (lower elevations), Holodiscus dumosus.

HERBS: Scarce.

CRYPTOGAMS: Well represented on microsites without litter.

DIS: NM, AZ, s-CO.; extensive in the Pinaleno Mountains, AZ.

ALSO SEE: PIEN/ACGL has better expressions of shrubs and herbs, but grades to ABLA/MOSS; PIEN/MOSS (USFS 1986a) altogether lacks Abies lasiocarpa, and occurs on dry high elevation sites in the Chiricahua Mts.

COMMENTS:

H.T.: Subalpine fir/moss

REGENERATION METHODS:

Clearcut: May favor aspen if present, otherwise not usually successful unless promptly planted.

Shelterwood: Usually successful, favors Engelmann spruce.

Seed Tree: Not usually successful.

Selection: Favors subalpine fir.

PLANTING:

Recommended Species: Engelmann spruce.

Success Probability: Moderate

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	H	H	B
Burning	H	H	

REVEGETATION: After disturbance moderate.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 0

TSI:

PRODUCTIVITY: PIEN

Site Index 54 + 11 _____ _____ Productivity Low to moderate

Forage Value Rating (Cattle): Early Seral Moderate Late Seral None

OTHER: Dry habitat type occurs typically near ridges and upper slopes. Poor site for aspen.

Abies lasiocarpa/Vaccinium myrtillus

Corkbark fir/Myrtle huckleberry
ABLA/VAMY

Typic phase 003200
Jamesia americana phase 003203

SYN: ABLA-PIEN1/VAMY (Johnston 1984); ABLA/VASC (Moir and Ludwig 1979).

SITE: All slopes and aspects > 10,000 ft.; n-facing slopes to 9,500 ft. MAP 30-35 in/yr.; heavy winter snowpack.

TES: 7, 0 LSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUSC	JUDE	QUGA	QUHY
C	C		S		a							

SHRUBS: Well represented. Vaccinium myrtillus*, Lonicera utahensis, Jamesia americana (well represented in Jamesia phase), Ribes wolfii, R. montigenum, Sorbus dumosa, Rubus parviflorus.

HERBS: Common to well represented. Bromus ciliatus, Trisetum montanum, Erigeron eximius, Ramischia secunda, Epilobium angustifolium,, Pedicularis racemosa, Oreochrysum parryi.

CRYPTOGAMS: Abundant to luxuriant, especially mosses.

DIS: Fort Apache Res., Pinaleno Mts (Coronado NF), White Mts, AZ; Mogollon Mts (Gila NF), NM, n NM and s CO, s UT (La Sal Mts).

ALSO SEE: ABLA-PIEN1/VASC (Johnston 1984) is closely related but has Pinus contorta as a major seral tree. ABLA/CAFO when Vaccinium myrtillus <5% cover; scree forest on talus slopes where Vaccinium is patchy.

COMMENTS: Southernmost occurrence in U.S. of this widespread type is found in Pinaleno Mts. Clearcuts and road clearings are dominated by Carex foenea in Pineleno Mts.

H. T.: Corkbark fir/Myrtle huckleberry

REGENERATION METHODS:

Clearcut: Favors spruce over fir.

Shelterwood: Heavy shelter favors fir, less shelter favors spruce.

Seed Tree: Often unsuccessful because of blowdown.

Selection: Favors fir.

PLANTING:

Recommended Species: Engelmann spruce, corkbark fir.

Success Probability: High

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	H		B
Burning	H	H	H

REVEGETATION: Slow to moderate due to short growing season.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 0.6 (Typic)
0.8 (RUPA, LIBO)

TSI: Sometimes needed to reduce stocking and improve species composition.

PRODUCTIVITY: 20 [/\ ] 100

Site Index 57 + 12 (PIEN) _____ _____ N = 98

Resource Value Rating (Cattle): Early Seral Low Late Seral None

OTHER: Important for snow retention. RUPA and LIBO phases tend to be more productive than typic phase.

Picea engelmannii/Acer glabrum

Engelman spruce/Rocky Mountain maple 004300
PIEN/ACGL

SYN:

SITE: North and east facing mountain slopes >9000 ft; MAP = 33-34 in/yr, MAST = 40-41 F.; moderate winter snowpack.

TES: 7,-1 LSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUSC	JUDE	QUGA	QUHY
	C		S	s	S	s	a					

SHRUBS: Scarce to locally well represented. Acer glabrum, Holodiscus dumosus, Physocarpus monogynus, Lonicera arizonica.

HERBS: well represented. Bromus ciliatus, Festuca sororia, Pteridium aquilinum, Fragaria americana, Smilacina spp., Viola canadensis, Senecio bigelovii, Erigeron eximius.

DIS: Chiricahua Mts (Coronado NF), AZ

ALSO SEE: PIEN/MOSS (USFS 1986a) if herbs and shrubs become sparse on drier sites. Closely resembles ABLA/MOSS except for absence of Abies lasiocarpa.

COMMENTS: Southernmost Engelman spruce forest in U.S.

Abies concolor/Acer glabrum

White fir/Rocky Mountain maple
ABCO/ACGL

001010

SYN: Abies concolor-Pseudotsuga menziesii/Acer glabrum (Johnston 1984).

SITE: Often n- or e-slopes, 9,000-9,800 ft., (as low as 8,500 ft. along drainages); MAP 29 in/yr.

TES: 6, +1.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIFL	QUGA	PIPO	PIED	JUSC	JUMO	JUDE
	a		S	C	C	s		a				

SHRUBS: Well represented or abundant. Acer glabrum*, Salix scouleriana, Amelanchier alnifolia, Holodiscus dumosus, Quercus gambelii, Physocarpus monogynus, Pachistima myrsinites, Symphoricarpos oreophila, Lonicera arizonica, Berberis repens, Robinia neomexicana, Jamesia americana.

HERBS: Well represented. Bromus ciliatus, Artemisia franserioides, Viola canadensis, Oreochrysum parryi, Thalictrum fendleri, Fragaria americana, Osmorhiza depauperata, Geranium richardsonii, Lathyrus arizonicus, Smilacina racemosa, Disporum trachycarpum.

CRYPTOGAMS:

DIS: Widespread throughout mountains of the Southwest.

ALSO SEE: ABCO/EREX has a luxuriant herbaceous understory.

COMMENTS: Abies concolor is occasionally absent in some isolated mountain ranges by accident of dispersal and migration.

H. T.: White fir/Rocky Mountain maple

REGENERATION METHODS:

Clearcut: Favors aspen and maple.

Shelterwood: Is usually successful.

Seed Tree: Sometimes successful, can favor Douglas-fir if seed trees are Douglas-fir.

Selection: Favors white fir.

PLANTING:

Recommended Species: Douglas-fir.

Success Probability: High

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	B	B	B
Burning	A	A	

REVEGETATION: Rapid due to sprouting.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.7

TSI: Sometimes needed to reduce white fir and budworm susceptibility.

PRODUCTIVITY: 20 /\ 100

Site Index 61 + (PSME) N = 24

Forage Value Rating (Cattle): Early Seral H Late Seral L

OTHER: Maple component lends high visual quality in autumn. Good potential for aspen management. Excellent browse and hiding cover for wildlife (especially deer, elk, black bear).

Abies concolor/Acer grandidentatum

White fir/Big toothed maple
ABCO/ACGR

001080

SYN:

SITE: Cool, shaded draws and intermittent drainages; 6,500-8,500 ft.

TES: 6, 0,+1 LSC

TREES:

ABCO	PSME	PIST	PIPO	PIED	PIFD	PIID	JUDE	JUSC	JUOC	JUMO	QUGA	QUHY	QUAR	QUEM	ACGR
C	c	c	s								s				C

SHRUBS: Abundant. Acer grandidentatum*, Quercus gambelii, Holodiscus dumosus, Rubus neomexicanus, Robinia neomexicana, Pachistima myrsinites, Symphoricarpos oreophilus.

HERBS: Well represented to abundant. Carex foenea, Bromus ciliatus, Poa fendleriana, Aquilegia chrysantha, Thalictrum fendleri, Smilacina racemosa.

DIS: widespread in c and s AZ, s NM.

ALSO SEE: Whittaker and Niering (1965), Moir and Ludwig (1979).

COMMENTS: One of the best habitats for black bear because of dense cover.

Abies concolor/Berberis repens

White fir/Oregon grape
ABCO/BERE

001020

SYN: Abies concolor-Pseudotsuga menziesii/(sparse understory) (Moir and Ludwig 1979), ABCO-PSME/sparse (Johnston 1984), ABCO/sparse (DeVelice et al 1986).

SITE: Numerous slopes, aspects, and landforms 8,500-9,500 ft.; MAP 27-28 in/yr.

TES: 6, 0.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	QUGA	PIED	JUSC	JUDE	JUMO
a	a		S	C	C	S	s					

NO SHRUB OR HERB SPECIES IS DIAGNOSTIC OR INDICATIVE OF THIS HABITAT TYPE.

SHRUBS: Common or well represented. Quercus gambelii, Robinia neomexicana, Symphoricarpos oreophilus, Berberis repens, Holodiscus dumosus, Lonicera spp., Pachistima myrsinites, Rubus parviflorus, Sambucus spp.

HERBS: Scarce (occasional species may reach 2-3 percent cover). Oreochrysum parryi, Thalictrum fendleri, Pteridium aquilinum, Carex rossii, Fragaria spp., Bromus ciliatus, Poa fendleriana, Smilacina spp.

Sparseness of herbs in mature stands is diagnostic.

CRYPTOGAMS:

DIS: Widespread throughout NM, CO, AZ, UT.

ALSO SEE: ABCO-PSME/SYORI (Johnston 1984); Abies concolor/Symphoricarpos oreophilus h.t. (Youngblood and Mauk 1985). If Quercus gambelii attains > 5 percent cover and shade tolerant herbs are well represented, then see ABCO/QUGA.

COMMENTS: Seral stages may be difficult to assign to this h.t. because shrubs and herbs can be well represented or abundant.

H. T.: White fir/Oregon grape; White fir/sparse

REGENERATION METHODS:

Clearcut: May be needed in mistletoe infected stands and usually successful if followed by planting.

Shelterwood: Usually successful; heavy shelter favors white fir over other conifers.

Seed Tree: Sometimes successful if seed trees are Douglas-fir or ponderosa pine.

Selection: Favors white fir.

PLANTING: Dougals-fir, Southwestern white pine, ponderosa pine.

Recommended Species:

Success Probability: Moderate to high.

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	H	B	
Burning	H	B	

REVEGETATION: Moderate to slow due to dryness or nutrient restrictions; Aspen is usually short-lived.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.7

TSI: Sometimes needed.

PRODUCTIVITY: 20 _____/_____ 100

Site Index 71 + 10 (PIPO) 67 + 12 (PSME) _____ N = 67

Resource Value Rating (Cattle): Early Seral M-H Late Seral None

OTHER: Poor site quality for aspen; early seral stages are productive for wildlife forage. Some common seral shrubs include Sambucus, Rubus strigosus, Ribes spp., Symphoricarpos oreophilus, Robinia neomexicana, Holodiscus dumosus, Quercus gambelii. Herbs also respond well and include both grasses and numerous forbs.

Abies concolor/Carex foenea

White fir/Fony sedge
ABCO/CAFO

001150

SYN:

SITE: Variety of sites between 9,000-9,500 ft.

TES: 6,+1 HSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUDE	JUSC	JUMO	QUGA
	a		s	C	C	S	s					

SHRUBS: Poorly represented. Acer glabrum, Ribes pinetorum, Holodiscus dumosus.

HERBS: Luxuriant. Carex foenea, Bromus ciliatus, Poa pratensis, Muhlenbergia montana, Carex rossii, Geranium richardsonii, Thalictrum fendleri, Senecio wootoni, Pteridium aquilinum

DIS: Pinaleno and Santa Catalina Mts, AZ.

ALSO SEE: ABCO/MUVI, Muldavin et al (1986).

COMMENTS:

Abies concolor/Erigeron eximius

White fir/Forest fleabane
ABCO/EREX

001030

SYN: Abies concolor-Pseudotsuga menziesii/Erigeron eximius (Johnston 1984).

SITE: Numerous slopes, aspects, and landforms between 8,700-9,700 ft.; MAP 29 in/yr.

TES: 6, +1.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUOS	JUSC	JUDE	JUMO
	a		S	C	C	s	a					

SHRUBS: Scarce to abundant. Acer glabrum, Salix scouleriana, Holodiscus dumosus, Quercus gambelii, Ribes pinetorum, Lonicera arizonica, Pachistima myrsinites, Robinia neomexicana, Symphoricarpos oreophila.

HERBS: Luxuriant. Erigeron eximius, Oreochrysum parryi, Lathyrus spp., Geranium richardsonii, Valeriana capitata, Fragaria ovalis, Artemisia franserioides, Viola canadensis, Bromus ciliatus, Trisetum montanum, Carex foenea, Actaea rubra, Osmorhiza depauperata.

CRYPTOGAMS:

DIS: Local in forests of AZ and s-UT; widespread in NM and s-CO.

ALSO SEE: ABCO/ACGL is very similar, but has less herb cover, and may indicate more cobbly or stony soils.

COMMENTS:

H. T.: White fir/Forest fleabane

REGENERATION METHODS:

Clearcut: Favors aspen and to lesser extent, Douglas-fir. Usually needs planting to assure conifer regeneration.

Shelterwood: Usually successful.

Seed Tree: Sometimes successful if Douglas-fir are seed trees.

Selection: Favors white fir.

PLANTING:

Recommended Species: Douglas-fir, Southwestern white pine, white fir.

Success Probability: High

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	H	B	B
Burning	A	A	

REVEGETATION: Rapid, strong herb and shrub response.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.7

TSI: Sometimes needed to reduce proportion of white fir and to reduce budworm susceptibility.

PRODUCTIVITY: 20 ___/_____ 100

Site Index 72 + 9 (PSME) _____ _____ N = 28

Forage Value Rating (Cattle): Early Seral H Late Seral M

OTHER: Good wildlife food and cover. Good potential for aspen management. Luxuriant understories have high visual appeal in mature stands along roads or bordering meadows.

Abies concolor/Muhlenbergia virescens

White fir/Screwleaf muhly
ABCO//MUVI

001060

SYN:

SITE: Ridgetops to midslopes, 8,000-9,200 ft.; MAP 26-27 in/yr; high evapotranspiration; dry season May-June.

TES: 6, 0 HSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	QUGA	PIED	JUSC	JUDE	JUMO
			s	C	C	s	S	s				

SHRUBS: Scarce. Occasional Quercus gambelii, Rosa sp., Ribes pinetorum

HERBS: Abundant or luxuriant. Muhlenbergia virescens*, Bromus ciliatus, Poa fendleriana, Carex rossii,Sitanion hystrix, Lupinus argenteus, Lathyrus graminifolius, Vicia pulchella, Pteridium aquilinum, Thermopsis pinetorum, Senecio wootoni, Senecio neomexicanus, Oreochrysum parryi, Poa pratensis (disturbed sites).

DIS: White Mts, Fort Apache Res., AZ; Mogollon Mts, Black Range, NM.

ALSO SEE: PSME/MUVI if Abies concolor is accidental; ABCO/FEAR (USFS 1986a) if Muhlenbergia virescens is absent; ABCO/QUGA, MUVI phase if Quercus gambelii (as trees or shrubs) >5% cover.

COMMENTS: On disturbed sites (from repeated burning or long history of heavy livestock use) Pteridium aquilinum, Lupinus argenteus, or Poa pratensis may dominate. In dense pole stands the herbaceous layer is often sparse, but occasional Muhlenbergia virescens clumps may persist.

Abies concolor/Quercus gambelii

White fir/Gambel oak
ABCO/QUGA

001050

SYN: ABCO-PSME/QUGA (Johnston 1984).

SITE: A wide array of sites, 7,400-9,600 ft., but commonly on moderate to very steep slopes; MAP 27 in/yr (can be as low as 24 in/yr e.g., Sunspot, NM).

TES: 6, 0.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	QUGA	PIED	JUSC	JUDE	JUMO
			a	C	C	S	S	S	a		a	

SHRUBS: Usually abundant. Quercus gambelii*, Robinia neomexicana, Symphoricarpos oreophilus, Rosa spp., Pachistima myrsinites, Berberis repens, Jamesia americana.

HERBS: Well represented or abundant. Poa fendleriana, Bromus ciliatus, Carex rossii, Koeleria macrantha, Muhlenbergia virescens, Muhlenbergia montana, Pteridium aquilinum, Geranium spp., Thalictrum fendleri, Achillea millefolium, Vicia americana, Lathyrus arizonicus, Thermopsis divaricarpa.

CRYPTOGAMS: Infrequent on ground, but lichens may be common as epiphytes.

DIS: Common and widespread throughout the Southwest (AZ, NM, UT, s-CO).

ALSO SEE: ABCO/MUVI or ABCO/BERE if Quercus gambelii is poorly represented.

COMMENTS:

H. T. White fir/Gambel oak

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually unsuccessful	oak, strongly
SHELTERWOOD	is often the best method	conifers
SEED TREE	is usually unsuccessful	oak
SELECTION	is usually successful	white fir, conifers

PLANTING

RECOMMENDED SPECIES ponderosa pine, Douglas-fir

SUCCESS PROBABILITY high

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak
BURNING	oak
NONE	conifers

REVEGETATION rapid due to oak sprouting

STOCKABILITY 1.0 BUDWORM SUSCEPTABILITY 1.5

TSI usually need to precommercially thin the white fir; release may also be required.

PRODUCTIVITY

SITE INDEX $\frac{61}{\text{PSME}} \pm 12$ $\frac{59}{\text{PIPO}} \pm 10$ N = 20

FORAGE VALUE RATING (CATTLE): EARLY SERAL L-M LATE SERAL L-none

OTHER Good food and cover for wildlife in all successional stages.

Picea pungens/Festuca arizonica

Blue spruce/Arizona fescue
PIPU/FEAR

006080

SYN:

SITE: Gentle to steep, s- to w-slopes, 8,200-9,200 ft., in frost pockets or cold air drainages, often adjoining meadows.

TES: 6, -1.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIFL	PIAR	PIPO	PIED	JUSC	JUMO	QUGA
		C	s	c	C	s		S				

SHRUBS: Scarce. Ribes cereum, R. pinetorum.

HERBS: Well represented or abundant. Festuca arizonica*, Muhlenbergia montana, Carex foenea, C. rossii, Danthonia parryi, Koeleria macrantha, Sitanion hystrix, Erigeron formosissimus, Potentilla hippiana, Fragaria spp., Lathyrus spp., Muhlenbergia virescens.

DIS: NM, c- and n-AZ, s-CO.

ALSO SEE:

COMMENTS:

H. T.: Blue spruce/Arizona fescue

REGENERATION METHODS:

Clearcut: Sometimes successful, can favor aspen or ponderosa pine. Clearcuts should be planted promptly to avoid grass competition.

Shelterwood: Usually successful, favors spruce and Douglas-fir.

Seed Tree: Sometimes successful, favors ponderosa pine.

Selection: Favors spurce.

PLANTING:

Recommended Species: Ponderosa pine, Douglas-fir, blue spruce.

Success Probability: High

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	B	B	B
Burning	B	B	B

REVEGETATION: Usually rapid.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.0

TSI: Sometimes needed to reduce stocking and increase proportion of ponderosa pine.

PRODUCTIVITY: 20 ___/_____ 100

Site Index _____ _____ $\frac{48 + ?}{\text{PSME}}$ N = 4

Forage Value Rating (Cattle): Early Seral H Late Seral L

OTHER: High visual quality when adjoining meadows or roads (diversity of trees); usually relatively poor site for aspen. Moderate site for ponderosa pine (better than limited data for Douglas-fir suggests).

Picea pungens/Carex foenea

Blue spruce/Fony sedge
PIPU/CAFO

006060

SYN:

SITE: Lower slopes and drainages, streamsides, and forest borders of grassy parks, 8,600-9,100 ft.; frost pockets or cold air drainages.

TES: 6, O.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	QUGA	PIED	JUSC	JUMO	JUDE
		C	S	c	C	s	S					

SHRUBS: Scarce to well represented. Juniperus communis, Pachistima myrsinites, Lonicera arizonica, Quercus gambelii, Holodiscus dumosus.

HERBS: Abundant (sometimes luxuriant). Carex foenea, Bromus ciliatus, Muhlenbergia montana, Erigeron spp., Fragaria americana, F. ovalis, Lathyrus arizonicus, Oreochrysum parryi, Thalictrum fendleri, Senecio wootoni, Galium spp., Poa pratensis.

DIS: NM, AZ, and s-CO.

ALSO SEE: PIPU/FROV (Alexander et al 1984).

COMMENTS:

H. T.: Blue spruce/Fony sedge

REGENERATION METHODS:

Clearcut: Favors aspen. Can favor ponderosa pine or Douglas-fir if planted promptly.

Shelterwood: Heavy shelter favors blue spruce and white fir; lighter shelter favors ponderosa pine and Douglas-fir. Blowdown may be a problem on poorly drained soils. Favors aspen.

Seed Tree: Blowdown of seed trees may be a problem.

Selection: Favors white fir or blue spruce.

PLANTING:

Recommended Species: Ponderosa pine, Douglas-fir, blue spruce, white fir.

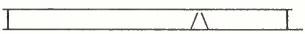
Success Probability: High. Be careful on poorly aerated, clayey soils.

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical		B	B
Burning	A	B	B

REVEGETATION: Rapid.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.0

TSI: Sometimes needed to reduce stocking and increase proportion of ponderosa pine.

PRODUCTIVITY: 20  100

Site Index 73 + ? (PIPO) 89 + ? (PSME) _____ N = 3

Forage Volue Rating (Cattle): Early Seral High Late Seral Low

OTHER: High visual quality with pleasing arrangement of tall, large-diameter pine mixed with aspen and blue spruce. Good potential for producing contrasting stands adjacent to one another.

Picea pungens/Erigeron eximius

Blue spruce/Forest fleabane
PIPU/EREX

Typic phase 006070
PIPO phase 006071

SYN: Picea pungens-Pseudotsuga menziesii h.t., Valeriana acutiloba phase (Moir and Ludwig 1979); PIPU-PSME/EREX (Johnston 1984).

SITE: Gentle slopes and plateau summits, 9,000-9,400 ft.; moderate and steep n-slopes adjoining canyon bottom drainages > 8,000 ft.; cold air drainages and frost pockets.

TES: 7, -1 (typic phase); 6, +1 (PIPO phase).

TREES: (by phase)

	ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUOS	JUSC	JUMO	QUGA
Typic phase		c	C	S	s	C	s						
Pinus ponderosa phase			C	S	c	C	s	s					

SHRUBS: Well represented. Acer glabrum, Quercus gambelii, Amelanchier alnifolia, Lonicera arizonica, Pachistima myrsinites, Juniperus communis, Rosa arizonica.

HERBS: Abundant to luxuriant. Erigeron eximius, E. formosissimus, Thalictrum fendleri, Fragaria americana, F. ovalis, Geranium richardsonii, Artemisia franserioides, Viola canadensis, Smilacina spp., Valeriana capitata, Bromus ciliatus, Poa fendleriana, Koeleria macrantha, Carex spp.

CRYPTOGAMS: Abundant.

DIS: NM, AZ, s-CO.

ALSO SEE: PIEN/EREX where Picea pungens can be seral.

COMMENTS:

H. T.: Blue spruce/Forest fleabane

REGENERATION METHODS:

Clearcut: Favors aspen; conifer regeneration sometimes susceptible to frost damage.

Shelterwood: Usually successful; heavy shelter favors spruce, lighter shelter favors Douglas-fir.

Seed Tree: Sometimes successful.

Selection: Favors spruce and white fir.

PLANTING:

Recommended Species: Blue spruce, Douglas-fir.

Success Probability: High

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	H	B	B
Burning	A	A	

REVEGETATION: Usually rapid.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.5

TSI: Sometimes needed to reduce stocking and reduce proportion of white fir.

PRODUCTIVITY: 20 /\ 100

Site Index 63 + 10 (PSME) _____ _____ N = 10

Forage Value Rating (Cattle): Early Seral M Late Seral L

OTHER: High visual quality along meadow borders and roads; good potential for thermal and hiding cover; good possibilities for aspen management.

Pseudotsuga menziesii/Acer grandidentatum

Douglas-fir/Big toothed maple 012390
PSME/ACGR

SYN:

SITE: n-slopes or streamside terraces, 5300-7200 ft.

TES: 6, 0 HSC

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIDI	JUDE	QUAR	ACGR	ARAR
					C		s	S		s	C	s

SHRUBS: Abundant or luxuriant. Shrubby Acer grandidentatum, Quercus rugosa, Quercus chrysolepis, Quercus hypoleucoides, Lonicera arizonica, Berberis repens, Rhamnus betulaefolia, Rubus neomexicanus, Symphoricarpos oreophilus, Quercus gambelii.

HERBS: Common. Poa fendleriana, Bromus ciliatus, Brickellia grandiflora, Cystopteris fragilis, Galium asperrimum.

DIS: Presently known from Galiuro Mts (Coronado NF), AZ.

ALSO SEE: ABCO/ACGR is similar, but does not have the evergreen oaks. If Fraxinus pennsylvanica is common along intermittent streams, see riparian forest.

Pseudotsuga menziesii/Bromus ciliatus

Douglas-fir/Fringed brome
PSME/BRCI

012320

SYN:

SITE: Ridges and upper slopes with deep soils, 9,300- 10,100 ft.; cold, wet, windy sites, but dry in May and June.

TES: 6, +1.

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	QUGA	PIED	JUSC	JUDE	JUMO
	a		s	a	C	S	s					

SHRUBS: Scarce to abundant. Holodiscus dumosus, Acer glabrum, Physocarpus monogynus, Jamesia americana, Ribes pinetorum.

HERBS: Luxuriant. Bromus ciliatus, Poa fendleriana, Trisetum montanum, Muhlenbergia montana, Erigeron eximius, Oreochrysum parryi, Thalictrum fendleri, Vicia americana, Smilacina stellata, Achillea lanulosa, Carex rossii.

CRYPTOGAMS:

DIS: Pinaleno Mts (Coronado NF), AZ; Mogollon, San Mateo, Magdalena, and Jemez Mts, NM.

ALSO SEE: ABCO/EREX if Abies concolor has common regeneration in mature stands.

COMMENTS:

H. T.: Douglas-fir/Fringed brome

REGENERATION METHODS:

Clearcut: Can be successful if planted promptly. Large openings are subject to wind scouring.

Shelterwood: Is usually successful.

Seed Tree: Windthrow is a problem especially when soils are wet.

Selection: Favors Douglas-fir.

PLANTING:

Recommended Species: Southwestern white pine, Douglas-fir.

Success Probability: High if planted before site is occupied by grasses and sedges.

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	H	B	B
Burning		B	B

REVEGETATION: Rapid due to herbaceous regrowth.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 1.7

TSI: Sometimes needed to reduce stocking.

PRODUCTIVITY: (no data)

Site Index _____ _____ _____ Productivity Moderate

Resource Value Rating (Cattle): Early Seral H Late Seral M-L

OTHER: Excellent summer range for deer and elk. Early seral stages have good forage for turkeys and small mammals.

Pseudotsuga menziesii/Muhlenbergia virescens

Douglas-fir/Screwleaf muhly 012350
PSME/MUVI

SYN: Pseudotsuga menziesii-Pinus strobiformis/Muhlenbergia virescens (Moir andLudwig 1979)

SITE: Upper slopes and ridges, elevated plains; 8,200-9,400 ft.; MAP 25 in/yr.

TES: 6, -1 HSC

TREES: (by phase)

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUDE	JUSC	JUMO	QUGA
				a	C	C	C					

SHRUBS: Scarce. Quercus gambelii, Quercus rugosa, Robinia neomexicana, Ceanothus fendleri.

HERBS: Abundant. Muhlenbergia virescens, Koeleria macrantha, Bromus ciliatus, Carex geophila, Carex rossii, Lathyrus graminifolius, Vicia pulchella, Lithospermum multiflorum, Hieracium fendleri, Senecio wootoni, Pteridium aquilinum, Solidago spp.

DIS: s-AZ and sw-NM

ALSO SEE: PIPO/MUVI and ABCO/MUVI; if Quercus gambelii >5% cover, see PSME/QUGA.

COMMENTS:

H. T. Douglas-fir/Screwleaf muhly

REGENERATION	Timber Objective	Favors
CLEARCUT	is sometimes needed in dwarf mistletoe stands	grass
SHELTERWOOD	is usually the most successful	ponderosa and Southwestern white pine
SEED TREE	is usually unsuccessful	
SELECTION	is usually successful	Dougals-fir

PLANTING

RECOMMENDED SPECIES Douglas-fir, ponderosa pine, southwestern white pine

SUCCESS PROBABILITY high

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	grass
BURNING	grass
NONE	conifers

REVEGETATION usually rapid

STOCKABILITY 1.0 BUDWORM SUSCEPTABILITY 1.5

TSI usually need to precommercially thin; release is not necessary.

PRODUCTIVITY

SITE INDEX $\frac{70}{\text{PSME}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL high LATE SERAL moderate

OTHER Good potential for wildlife (deer and elk) forage in early seral stage and wildlife cover in later stages. Good livestock grazing potential.

Pseudotsuga menziesii/Quercus arizonica

Douglas-fir/Arizona white oak
PSME/QUAR

012430

SYN:

SITE: Gentle to steep mountain slopes, 6,800-7,200 ft. extending down intermittent drainages to about 6,200 ft; MAP 26 in/yr, MAAT 46 F. (s facing slopes at 7200 ft on Mazatzal Peak: MAP 29.6 in/yr, MAAT 46 F from TES climatic gradients).

TES: 6, -1 HSM

TREES:

ABCO	PSME	PIST	PIPO	PIEFDI	JUDE	JUOSC	QUGA	QUHY	QUAR	QUEM
	C	c	C	c	C				S	s

SHRUBS: Well represented. shrubby forms of oaks, Ceanothus fendleri, Quercus chrysolepis (cooler or wetter sites), Arcotstaphylos pungens, A. pringlei, Agave parryi.

HERBS: Well represented. Muhlenbergia longiligula, Muhlenbergia montana, Poa fendleriana, Koeleria macrantha, Pedicularis centranthera, Hedeoma hyssopoifolium.

DIS: Central AZ south of the Mogollon Rim, Sierra Ancha and Mazatzal Mts

ALSO SEE: Muldavin et al (1986). PIPO/QUAR if Pseudotsuga menziesii is accidental or occasional (<10 trees/acre in mature stands).

COMMENTS: Ceanothus fendleri and manzanitas can be important shrubs after fire; also fire can be useful to invigorate oak sprouting.

H. T. Douglas-fir/Arizona white oak

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually unsuccessful	oak and alligator juniper
SHELTERWOOD	is usually successful	ponderosa pine, Douglas-fir
SEED TREE	is not usually successful	oak and alligator juniper
SELECTION	is usually successful	Douglas-fir

PLANTING

RECOMMENDED SPECIES ponderosa pine, Douglas fir

SUCCESS PROBABILITY moderate

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak and alligator juniper
BURNING	oak and alligator juniper
NONE	Douglas-fir

REVEGETATION usually rapid from oak and alligator juniper sprouting.

STOCKABILITY 0.8 BUDWORM SUSCEPTABILITY 0

TSI may need precommercial thinning; release may also be necessary.

PRODUCTIVITY

SITE INDEX $\frac{55}{\text{PSME}}$ ±

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER

Pseudotsuga menziesii/Quercus gambelii

Douglas-fir/Gambel oak
PSME/QUGA

QUGA phase 012140
MUVI phase 012142

SYN:

SITE: Numerous slopes, aspects, and landforms 6,900-8,000 ft.; often on restricted topography within Abies concolor zone (e.g. s-slopes) or within Pinus ponderosa zone (e.g. n-slopes).

TES: 6, -1 HSC, LSC.

TREES: (by phase)

	ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	QUGA	PIED	JUSC	JUDE	JUMO
QUGA, MUVI phases					a	C	s	S	S	s			

SHRUBS: (Including shrubby forms of Gambel oak) Well represented to luxuriant. Quercus gambelii*, Robinia neomexicana, Symphoricarpos oreophila, Pachistima myrsinites, Berberis repens, Rosa spp., Holodiscus discolor, Ceanothus fendleri.

HERBS: Well represented to abundant. Poa fendleriana, Koeleria macrantha, Carex rossii, Muhlenbergia virescens (> 5 percent cover in MUVI phase), Thalictrum fendleri, Vicia americana, Lathyrus arizonica, Achillea millefolium.

DIS: Widespread in NM, AZ, s-CO, UT.

ALSO SEE: If Quercus gambelii < 5 percent cover, see PSME/FEAR. If herbaceous cover < 5 percent see PSME/BERE.

COMMENTS:

Pseudotsuga menziesii/Quercus hypoleucoides

Douglas-fir/Silverleaf oak
PSME/QUHY

Pinus ponderosa phase 012360
Pinus leiophylla phase 012361
Quercus rugosa phase 012362

SYN: Pseudotsuga menziesii/Quercus rugosa (Muldavin et al 1986 for the Quercus rugosa phase).

SITE: Hot, dry, often w- or sw-facing mid and upper slopes and ridgetops, 7,500-8,600 ft.; n- or ne-facing lower or mid slopes 6,500-7,500 ft MAP 28-29 in/yr.

TES: 6, -1 HSM

TREES:	ABCO	PSME	PIST	PIPO	PILE	PIDI	PIED	JUDE	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM
PIPO phase	a	C	c	C		c	c	c				S	s	
PILE phase		C	a	C	c	c		c				S	s	a
QURU phase	a	C	C	c		a		c				s	s	

SHRUBS: Well represented. Quercus hypoleucoides, Q. rugosa (often abundant in QURU phase), Q. chrysolepis, Prunus serotina, Ceanothus fendleri, Cercocarpus montanus, Robinia neomexicana, Yucca baccata, Yucca schottii, Garrya wrightii.

HERBS: Well represented. Muhlenbergia longiligula, Poa fendleriana, Carex geophila, Koeleria macrantha, Brickellia spp., Hedeoma hyssopoifolium, Senecio neomexicanus, Erigeron neomexicanus, Thalictrum fendleri.

DIS: NM: Mogollon Mts, Black Range, Brushy Mts., Animas Mts;
AZ: Chiricahua, Pinaleno, Huachuca Mts., vicinity of Rose Peak, Natanes Plateau (San Carlos Res.).

ALSO SEE: Muldavin et al (1986). PIPO/QUHY if Pseudotsuga menziesii is accidental or occasional (<10 trees/acre in mature stands). PSME/QUAR if Quercus hypoleucoides is scarce; PSME/QURU if Quercus rugosa is well represented and silverleaf oak tends to be shrubby (windy exposures on shallow soils).

H. T. Douglas-fir/Silverleaf oak

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually not successful	oak
SHELTERWOOD	is usually successful	ponderosa pine, Douglas-fir
SEED TREE	is not usually successful	oak
SELECTION	is usually successful	Douglas-fir

PLANTING

RECOMMENDED SPECIES ponderosa pine, Douglas-fir

SUCCESS PROBABILITY moderate

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak and grasses
BURNING	oak and grasses
NONE	Douglas-fir

REVEGETATION rapid

STOCKABILITY 1.0 BUDWORM SUSCEPTABILITY 1.5

TSI sometimes need precommercial thinning; release may also be required.

PRODUCTIVITY

SITE INDEX $\frac{60}{\text{PSME}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER High potential for large oak production. Can be important for fuelwood.

Pinus leiophylla/Piptochaetium fimbriatum

Chihuahua pine/Pinyon ricegrass 033010
PILE/PIFI

SYN:

SITE: Upper alluvial terraces of streamsides and adjoining intermittent streams and washes, 5000-6000 ft; MAP 24 in/yr, MAST 51 F

TES: 5,-1 HSM

TREES:

ABCO	PSME	PIST	PIPO	PINEN	PILEC	PIDIC	JUDEC	JUOSC	JUSC	QUGA	QUHYs	QUARS	QUEMs	PLWRa

SHRUBS: well represented. Shrubby forms of Quercus spp., Nolina microcarpa, Rhus trilobata, Arctostaphylos pungens, Prunus serotina ssp virens, Rhamnus betulaefolia, Vitis arizonica, Fallugia paradoxa, Yucca schottii, Garrya wrightii.

HERBS: Abundant. Piptochaetium fimbriatum, Carex geophila, Bromus porteri, Aristida orcuttiana, Bouteloua curtipendula, Bouteloua gracilis, Muhlenbergia longiligula, Poa fendleriana, Senecio neomexicana, Desmodium rosei, Thalictrum fendleri, Brickellia lemmoni, Galium microphyllum, Phaseolus spp., Calliandra reticulata.

DIS: Peloncillo Mts, NM; Chiricahua Mts, Canelo Hills AZ

ALSO SEE: If Platanus wrightii is common see riparian forests. PILE/PIFI is mostly on alluvial soils, but along dry washes or toeslopes can intergrade to PILE/QUAR.

Pinus leiophylla/Quercus arizonica

Chihuahua pine/Arizona white oak
PILE/QUAR

033020

SYN:

SITE: 5200 (n slopes) to 7000 (s slopes); mountain slopes, intermittent washes, and dry streamside terraces; MAP 24 in/yr, MAST 51 F; soils often shallow (<50 cm to bedrock), cobbly, and with low water holding capacity.

TES: 5,-1 HSM

TREES:

ABCO	PSME	PIST	PIPO	PINEN	PILE	PIDI	JUDE	JUOS	JUSC	QUGA	QUHY	QUAR	QUME	ARAR
	a		c		C	C	C				s	S	S	

note: PIPO includes Pinus ponderosa var arizonica (P. arizonica).

SHRUBS: well represented. Shrubby forms of Quercus spp., Nolina microcarpa, Rhus trilobata, Arctostaphylos pungens, Carphochaete bigelovii, Yucca schottii, Agave parryi.

HERBS: Well represented. Muhlenbergia longiligula, Poa fendleriana, Carex geophila, Aristida orcuttiana, Cheilanthes fendleri, Hedeoma hyssopifolium, Calliandra reticulata, Senecio neomexicana, Phaseolus spp., Piptochaetium fimbriatum (if abundant see PILE/PIFI), Solidago sparsiflora, Artemisa carruthii, Schizachyrium cirratum, Panicum bulbosum, Muhlenbergia emersleyi.

DIS: Peloncillo Mts, NM; Chiricahua, Galiuro, Pinaleno Mts, AZ and some isolated locations on the Tonto NF and Fort Apache Res.

ALSO SEE: Pine-oak woodlands (Marshall 1957, Whittaker and Niering 1965, 1968), Muldavin et al (1986). The latter also describe a Pinus leiophylla/Quercus emoryi association which is included here in PILE/QUAR.

NOTE: In the Peloncillo Mts, PILE/QUAR is important habitat for Gould's turkey. Its extent (together with PILE/QUHY) within a portion of the the turkey's range was mapped by Willging (1987)

Pinus leiophylla/Quercus hypoleucoides

Chihuahua pine/Silverleaf oak 033030
PILE/QUHY

SYN:

SITE: 5700 (n slopes) to 7100 (s slopes); mountain slopes, intermittent washes, and dry streamside terraces; MAP 25 in/yr, MAST 50 F (TES gradient analysis, n slopes Santa Catalina Mts).

TES: 5,0 HSM

TREES:

ABCO	PSME	PIST	PIPO	PIEN	PILE	PIDI	JUDE	JUOS	JUSC	QUGA	QUHY	QUAR	QUEM	ARAR
	a		c		C	c	C				S	S	s	s

note: PIPO includes Pinus ponderosa var arizonica (P. arizonica).

SHRUBS: well represented. Shrubby forms of Quercus spp., Nolina microcarpa, Rhus trilobata, Arctostaphylos pungens, A. pringlei, Carphochaete bigelovii, Yucca schottii, Agave parryi.

HERBS: Well represented. Muhlenbergia longiligula, Poa fendleriana, Carex geophila, Aristida orcuttiana, Cheilanthes fendleri, Hedeoma hyssopifolium, Calliandra reticulata, Senecio neomexicana, Phaseolus spp., Piptochaetium fimbriatum (washes and streamside terraces).

DIS: Peloncillo Mts, NM; Chiricahua, Santa Rita, Pinaleno, and Santa Catalina Mts, AZ and outliers at Fort Apache Res.

ALSO SEE: PILE/QUAR occurs in slightly drier, warmer environments. Pine-oak woodlands have been described more generally by Marshall (1957), Whittaker and Niering (1965,1968), Niering and Lowe (1984).

Pinus ponderosa/Arctostaphylos pungens community type

Ponderosa pine/Manzanita
PIPO/ARPU

011420

SYN:

SITE: Mostly 5600-6600 ft on steep upper slopes, ridgetops, or elevated plains.

TES: 5,0 HSM/LSM

TREES:

ABCO	PSME	PIST	PIPO	PIED	PIFA	PIDI	JUDE	JUOS	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM	QURU
	a		C		c	c	C					a	S	S	

SHRUBS: abundant. Arctostaphylos pungens*, A. pringlei*, Garrya wrightii, Rhus trilobata, Agave parryi, Nolina microcarpa, Ceanothus fendleri, shrubby evergreen oaks (Q. arizonica, Q. emoryi), Rhamnus crocaea.

HERBS: *scarce or poorly represented. Scattered grasses and forbs (for list see PIPO/QUAR.

DIS: c-AZ south of Rim (mostly Tonto NF and San Carlos Res.)

ALSO SEE: Mapping units 5065 and 5440 of the Terrestrial Ecosystem Survey for Globe RD (USFS 1984)

COMMENTS: Muldavin et al (1986) interpret this c.t. as a fire derived expression of various ponderosa pine/evergreen oak h.t.s. Shrubs which are seed germinators after fire and can persist into mid or late succession include Arctostaphylos spp. and Ceanothus fendleri. The oaks are vigorous sprouters after fire.

H. T. Ponderosa pine/Manzanita

REGENERATION	Timber Objective	Favors
CLEARCUT	is not successful	manzanita
SHELTERWOOD	is often the best method	ponderosa pine
SEED TREE	is not usually successful	manzanita
SELECTION	is usually successful in stands without dwarf mistletoe	ponderosa pine

PLANTING

RECOMMENDED SPECIES ponderosa pine

SUCCESS PROBABILITY low

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	manzanita and oak when present
BURNING	manzanita and oak when present
NONE	ponderosa pine

REVEGETATION moderate

STOCKABILITY 0.7 BUDWORM SUSCEPTABILITY 0

TSI sometimes need precommercial thinning and release for ponderosa pine

PRODUCTIVITY

SITE INDEX $\frac{65}{\text{PIPO}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER Livestock grazing potential is low.

Pinus ponderosa/Bouteloua gracilis

Ponderosa pine/Blue grama — Quercus gambelii phase 011215
PIPO/BOGR

SYN:

SITE: Elevated plains 5700-6000 ft; MAP about 19 in/yr.

TES: 5,-1 HSC/LSC

TREES:	ABCO	PSME	PIST	PIPO	PIED	PIFA	PIDI	JUDE	JUOS	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM	
QUGA phase				C	C			C	c		a	s				

SHRUBS: Poorly represented. Shrubby oaks (mostly Q. gambelii, some Q. turbinella), Rhus trilobata, Gutierrezia sarothrae.

HERBS: Well represented to abundant, especially grasses. Bouteloua gracilis, Aristida fendleriana, Poa fendleriana, Stipa comata, Sitanion hystrix Koeleria macrantha, Solidago sparsiflora, Geranium caespitosum, Erigeron divergens, Leucelene ericoides, Carex spp.

DIS: Scattered locations s of Rim; Juniper Mesa (Prescott NF), Fort Apache Res.

ALSO SEE: PIPO/BOGR of Hanks et al (1983); other phases of PIPO/BOGR given in USFS (1986a, 1987a); TES subseries, PIPOS-PIED-JUDE2-JUMO-QUGA, especially mapping unit (MU) 523 on elevated plains (USFS 1987b). Other MUs within this subseries (505 of cindery soils, 186, 187, 189, 592, 628) occur on moderate to steep slopes n of the Rim (indicated as HSC climate).

H. T.: Ponderosa pine/Blue grama

REGENERATION METHODS:

Clearcut: Is usually unsuccessful.

Shelterwood: Is often the best method.

Seed Tree: Is not usually successful.

Selection: Is usually successful.

PLANTING:

Recommended Species: Ponderosa pine.

Success Probability: Low to moderate.

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	B	B	B
Burning		B	

REVEGETATION: Slow; sites may have high soil erosion potential.

STOCKABILITY: 0.8 BUDWORM SUSCEPTIBILITY: 0

TSI: Sometimes needed to reduce stocking.

PRODUCTIVITY: 20 _____/_____ 100

Site Index $\frac{60 + 18}{\text{PIPO}}$ N = 6

Forage Value Rating (Cattle): Early Seral ____H____ Late Seral __M___

OTHER: Large ponderosa pine may be important turkey roosts. Junipers may be important mid-seral dominants on some sites. Gambel oak, when present, offers mast and cover for wildlife. Fuel wood potential is often high.

Pinus ponderosa/Festuca arizonica

Ponderosa pine/Arizona fescue
PIPO/FEAR

FEAR phase 011090
QUGA phase 011093

SITE: Elevated and valley plains, piedmont hillslopes and mountain slopes, 7,200-8,800 ft. (to 9,400 ft. on s-slopes); MAP 20-25 in/yr.

TES: 5, 0,+1

TREES: (by phase)	ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIFL	PIAR	PIPO	PIED	JUSC	JUMO	QUGA
Festuca arizonica phase						a			C	a	a		
Quercus gambelii phase									C	s	a	a	s

SHRUBS: Scarce. Quercus gambelii (QUGA phase), Ribes cereum, Ceaonothus fendleri, Cerocarpus montana.

HERBS: Well represented to abundant. Festuca arizonica*, Muhlenbergia montana, Muhlenbergia virescens, Stipa pringlei, Koeleria macrantha, Blepharoneuron tricholepis, Carex rossii, Sitanion hystrix, Lithospermum multiflorum, Antennaria spp., Potentilla hippiana, Chrysopsis villosa, Artemisia ludoviciana, A. carruthii, Pteridium aquilinum, Poa pratensis.

DIS: Very local in Pinaleno Mts; Fort Apache Res., AZ; widespread north of Mogollon Rim.

ALSO SEE: Pinus ponderosa/Muhlenbergia virescens-Festuca arizonica (Fitzhugh et al 1987) and PIPO/MUVI may be indistinguishable on sites with a long livestock grazing history. Where Quercus gambelii occur as trees with grasses beneath, see PIPO/QUGA, Festuca arizonica phase.

COMMENTS: Poa pratensis or Pteridium aquilinum can dominate where fires or livestock grazing have had past or repeated occurrences.

H. T.: Ponderosa pine/Arizona fescue

REGENERATION METHODS:

Clearcut: Is sometimes needed in heavy mistletoe infected stands.

Shelterwood: Almost always successful. Regeneration is often very abundant, forming thickets or dense patches.

Seed Tree: Is often successful.

Selection: Favors ponderosa pine in mistletoe free stands.

PLANTING:

Recommended Species: Ponderosa pine.

Success Probability: High

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	B	B	
Burning	B	B	

REVEGETATION: Moderately rapid.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 0

TSI: Usually needed to reduce stocking. Regeneration of pine tends to form dense thickets when conditions are favorable.

PRODUCTIVITY: 20 _____/_____ 100

Site Index $\frac{58 + 13}{\text{PIPO}}$ N = 25

Forage Value Rating (Cattle): Early Seral High Late Seral M-L

OTHER: Open stands with grassy understories are "parklike" and attractive to recreationists. Poor potential for hiding cover expect where pine thickets exist. Burning can stimulate Ceanothus fendleri (an important browse species) on some sites. Prescribed fire can also be used to reduce pine thickets and maintain parklike views.

Pinus ponderosa/Juglans major

Ponderosa pine/Walnut
PIPO/JUMA

011470

SYN:

SITE: Dry terraces of intermittent washes or streamsides, 5500-5800 ft.

TES: 5,-1 to 5,+1

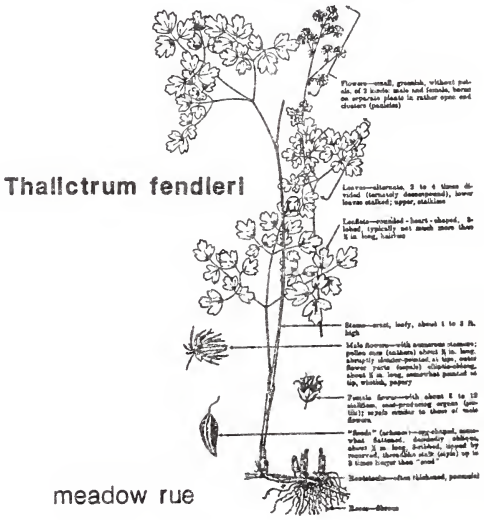
TREES:	A B C O	P S M E	P I S T	P I P O	P I E D	P I F A	P I D I	J U D E	J U O S	J U M O	J U S C	Q U G A	Q U H Y	Q U A R	Q U E M	J U M A
				C	a	a	a	C			c	S		s		S

SHRUBS: well represented. Shrubby forms of Quercus spp. and Juniperus spp. Rhus trilobata, Rhamnus betulaefolia, Vitis arizonica.

HERBS: abundant. Bromus spp., Agropyron smithii, Elymus longifolium, Poa pratensis, Elymus canadensis, Panicum bulbosum, Erigeron spp., Galium asperrimum, Thalictrum fendleri, and numerous other forbs.

DIS: occasional s of Rim.

ALSO SEE: Riparian forests if Alnus oblongifolia, Populus fremontii, or Acer negundo are common or not limited to microsites.



H. T. Ponderosa pine/Walnut

REGENERATION

CLEARCUT	is usually unsuccessful
SHELTERWOOD	is often the best method
SEED TREE	is not usually successful
SELECTION	is usually successful

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	ponderosa pine
BURNING	oak, if present
NONE	ponderosa pine

REVEGETATION moderate

PRODUCTIVITY

SITE INDEX $\frac{50}{\text{PIPO}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER High potential for walnut production.

Pinus ponderosa/Muhlenbergia montana

Ponderosa pine/Mountain muhly 011330
PIPO/MUMO

SYN: Pinus ponderosa/Poa longiliqula community type (Hanks et al 1983).

SITE: Gentle and moderate slopes, 7,500-8,500 ft.; MAP 22-23 in/yr. Precipitation at Jacob Lake AZ (7920 ft) is 18.5 in/yr, about 60% of which occurs from October through March.

TES: 5, 0.

TREES: (by geography)	ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIFL	PIPO	PIED	JUDE	JUSC	JUMO	QUGA
North Kaibab Plateau				a		a		C	a				
South of Rim						a	c	C	c	c			s
Elsewhere				a		a		C	c		c	c	s

SHRUBS: Common. Ceanothus fendleri, Quercus gambelii, Cercocarpus montanus, Berberis repens, Hymenoxys richardsonii.

HERBS: Well represented to abundant, especially grasses. Muhlenbergia montana, Blepharoneuron tricholepis, Poa fendleriana, Koeleria macrantha, Carex spp., Sitanion hystrix, Bouteloua gracilis (usually scarce), Andropogon spp., Lotus wrightii, Lithospermum multiflorum, Senecio neomexicanus, Erigeron flagellaris, Erigeron platyphyllus, Geranium caespitosum, Antennaria spp, Achillea millefolium, Lathyrus graminifolius

CRYPTOGAMS:

DIS: sw- and c-NM to CO; s-AZ to s-UT.

ALSO SEE: Pinus ponderosa/Festuca arizonica is distinguished by Festuca arizonica common. PIPO/MUMO described by Hess and Alexander (1986) and Youngblood and Mauk (1985) may be geographic phases. Certain stands classified as PIPO/BOGR, Bouteloua gracilis phase by Hanks et al (1983) are assigned here to PIPO/MUMO if Bouteloua gracilis < 5% cover.

COMMENTS: Seral stages of PIPO/FEAR, especially on livestock allotments (pine-bunchgrass range) can resemble PIPO/MUMO. Heavily grazed lands of PIPO/MUMO can also resemble PIPO/BOGR.

H. T.: Ponderosa pine/Mountain muhly

REGENERATION METHODS:

Clearcut: Sometimes successful and needed in mistletoe infected stands.

Shelterwood: Usually successful for ponderosa pine.

Seed Tree: Is often successful for ponderosa pine.

Selection: Is usually successful.

PLANTING:

Recommended Species: Ponderosa pine.

Success Probability: High or moderate.

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	B	B	B
Burning	B	B	B

REVEGETATION: Usually rapid.

STOCKABILITY: 1 BUDWORM SUSCEPTIBILITY: 0

TSI: Is often necessary, especially where regeneration occurs in dense patches.

PRODUCTIVITY: 20 _____/_____ 100

Site Index 58 + 13 (PIPO) _____ _____ N = 8

Forage Value Rating (Cattle): Early Seral H Late Seral M

OTHER: Low potential for wildlife hiding cover. Burning tends to stimulate germination of Ceanothus fendleri, an important browse species. Stands can have high visual quality where large pines occur in clumped mosaics over grassy understories. Prescribed fires can be useful to reduce conifer thickets, maintain visual quality, and stimulate herbage production.

Pinus ponderosa/Muhlenbergia virescens

Ponderosa pine/Screwleaf muhly
PIPO/MUVI

Muhlenbergia virescens phase 011340
Quercus gambelii phase 011341

SYN:

SITE: Numerous slopes and aspects 6800-8200; MAP 23-25 in/yr.

TES: 5,+1 HSM

TREES:	ABCO	PSME	PIST	PIPO	PIED	PIFI	PIDI	JUDE	JUOS	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM	
MUVI phase		a	c	C	s			s					s	s		
QUGA phase		a	c	C	s			s				s				

SHRUBS: scarce. Shrubby forms of oaks, Ceanothus fendleri, Symphoricarpos oreophilus.

HERBS: Abundant. Muhlenbergia virescens, Bromus porteri, Sitanion hystrix, Stipa pringlei, Muhlenbergia longiligula, Koeleria macrantha, Poa fendleriana, Carex geophila, Solidago spp., Senecio neomexicanus, Pseudocymopteris montanus, Hedeoma hyssopifolium, Hieracium fendleri, Pteridium aquilinum, Poa pratensis (especially on grazed sites).

DIS: sw- and c-NM, s- and c-AZ with outlier on San Francisco Peaks.

ALSO SEE: MUVI phase of PIPO/QUGA if Quercus gambelii is well represented; PIPO/FEAR if Festuca arizonica is common; PSME/MUVI if Douglas-fir exceeds about 10 trees/acre in mature stands.

H. T. Ponderosa pine/Screwleaf muhly

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually unsuccessful	grasses
SHELTERWOOD	is often the best method	ponderosa pine
SEED TREE	is often successful	grasses
SELECTION	is usually successful in dwarf mistletoe free stands	ponderosa pine

PLANTING

RECOMMENDED SPECIES ponderosa pine

SUCCESS PROBABILITY moderate

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	ponderosa pine; oak, if present
BURNING	oak, when present
NONE	ponderosa pine

REVEGETATION usually rapid especially when oak is present

STOCKABILITY 1 BUDWORM SUSCEPTABILITY 0

TSI sometimes need precommercial thinning; release may also be required.

PRODUCTIVITY

SITE INDEX $\frac{70}{\text{PIPO}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL high LATE SERAL moderate

OTHER Good summer range for elk and deer.

Pinus ponderosa/Quercus arizonica

Ponderosa pine/Arizona white oak
PIPO/QUAR

Typic phase 011410
Bouteloua gracilis ph. 011411

SYN:

SITE: One of the warmest, driest ponderosa pine environments. Elevations mostly 5500-6500 ft. Gradient analysis on s-facing aspects near Mazatzal Peak have the following climatic features:

Elev	MAAT	Sum	Win	MAST	MAP
5600	53.2	69.6	38.2	53.1	24.0
6000	51.5	67.7	36.7	51.2	25.4

MAAT = Mean Annual air temp.(F);
MAST = Mean Annual soil temp.(F).

For the wide range of soils and parent materials, see TES reports.

TES: 5,0 (typic phase) and 5,-1(BOGR phase), HSM

TREES: (by phase)	ABCO	PSME	PIST	PIPO	PIED	PIFD	PIDI	JUDE	JUOS	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM	
Typic	a	a	a	C	c	c	c	C			a	a	a	S	s	
B.gracilis				C	C	C	C	C						S	s	

SHRUBS: Common to well represented (depending upon fire history). Ceanothus fendleri, Arctostaphylos pungens, A. pringlei, Yucca schottii, Rhus trilobata, Mimosa biuncifera, Nolina microcarpa, Garrya wrightii, Gutierrezia sarothrae, shrubby forms of oaks, Cercocarpus montanus.

HERBS: Common or well represented. Muhlenbergia longiligula, Carex geophila, Poa fendleriana, Koeleria macrantha, Sitanion hystrix, Schizachyrium cirratum, Piptochaetium fimbriatum, Calliandra humilis, Geranium caespitosum, Lotus wrightii, Hedeoma hysssopifolium, Artemisia ludoviciana, A. carruthii.

DIS: Widespread south of the Rim; sw-NM and s-AZ

ALSO SEE: PIPO/QUGR described by Fitzhugh et al (1987) is perhaps indistinguishable. Vegetation subseries include (for northern portions of Tonto NF) PIPO-JUDE2-QUAR, PIPO-JUDE2-QUAR-ARPU5-ARPR, PIPO-JUDE2-QUAR-RONE-ARPR, PIPO-PIMO-JUDE2-QUAR-QUTU2-ARPU5-ARPR, and PIPO-JUDE2-QUAR-ARPU5-COME (on calcareous parent materials) and (for the Clifton RD, Apache NF) PIPOS-QUHY and PIPOS-PIED-QUHY (USFS 1986c, 1987b). Mapping units (MUs) with these subseries are likely to contain the PIPO/QUAR h.t. On the Globe RD see MUs 5024, 5345, 5864, and 5865 where the PIPO-PIMO-JUDE2-QUAR-ARPU5 subseries has been described (USFS 1984).

H. T. Ponderosa pine/Arizona white oak

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually unsuccessful	oak and alligator juniper
SHELTERWOOD	is often the best method	ponderosa pine
SEED TREE	is not usually successful	oak and alligator juniper
SELECTION	is usually successful	ponderosa pine

PLANTING

RECOMMENDED SPECIES ponderosa pine

SUCCESS PROBABILITY low

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak and alligator juniper
BURNING	oak and alligator juniper
NONE	ponderosa pine

REVEGETATION usually rapid from oak and juniper sprouting

STOCKABILITY 0.8 BUDWORM SUSCEPTABILITY 0

TSI sometimes need precommercial thinning; release may also be required.

PRODUCTIVITY

SITE INDEX $\frac{60}{\text{PIPO}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER This habitat type is important for deer and turkey and has some potential for livestock grazing. Can revegetate rapidly following fire due to sprouting of oak and alligator juniper. Fuelwood production is often a desirable objective in this type.

Pinus ponderosa/Quercus emoryi

Ponderosa pine/Emoryi oak
PIPO/QUEM

011440

SYN:

SITE: Mostly between 5300-6000 ft on a wide variety of slopes, landforms, and soils. However, PIPO/QUEM is most differentiated along small drainages with granitic soils (Udic Ustochrepts). MAP = 20-22 in/yr.

TES: 5,-1 LSM

TREES:

ABCO	PSME	PIST	PIPO	PIED	PIFI	PIDI	JUDE	JUOS	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM	
			C		c	c	C	s		a			s	S	

SHRUBS: similar to PIPO/QUAR.

HERBS: Scarce to common. For list see PIPO/QUAR.

DIS: Widespread south of the Rim; sw-NM and s-AZ

ALSO SEE: PIPO/QUAR is very similar. Muldavin et al (1986ab) distinguish PIPO/QUEM by Emory oak being well represented (in mature stands), whereas in PIPO/QUAR this oak is poorly represented. Mapping unit 5351 near Payson, AZ contains examples of PIPO/QUEM described within the PIPO-PIMO-JUDE2-QUAR-QUTU2-ARPU5 subseries (USFS 1986c). PIPO/QUEM appears to be a weakly differentiated association somewhat hotter and drier than PIPO/QUAR.

H. T. Ponderosa pine/Emory oak

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually unsuccessful	oak
SHELTERWOOD	is often the best method	ponderosa pine
SEED TREE	is not usually successful	oak
SELECTION	is usually successful	ponderosa pine

PLANTING

RECOMMENDED SPECIES ponderosa pine

SUCCESS PROBABILITY low

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak and grasses
BURNING	oak and grasses
NONE	ponderosa pine

REVEGETATION usually rapid from oak sprouting

STOCKABILITY 0.8 BUDWORM SUSCEPTABILITY 0

TSI sometimes need precommercial thinning; release may also be important

PRODUCTIVITY

SITE INDEX $\frac{60}{\text{PIPO}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL low

OTHER Often important for turkey roost areas in a generally woodland environment. Fuelwood production is often important.

Pinus ponderosa/Quercus gambelii

Ponderosa pine/Gambel oak
PIPO/QUGA

SYN:

Quercus gambelii phase	011210
Festuca arizonica phase	011211
Muhlenbergia longiligula	011212
Pinus edulis phase	011213
Muhlenbergia montana ph.	011214
Bouteloua gracilis phase	011215

SITE: 6,000-7,800 ft. on wide variety of slopes, landforms, and soils.

TES: 5,+1 (QUGA and FEAR phases) to 5, -1 (PIED, MULO, BOGR phases).

TREES: (by phase)

	ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	PIED	JUDE	JUSC	JUMO	JUOS	QUGA
QUGA and FEAR						a		C	a		c			S
PIED						a		C	C		c	c	c	S
MULO and BOGR						a		C	c	C			s	S

SHRUBS: Well represented to abundant. Quercus gambelii (shrubby forrms), Symphoricarpos oreophilus, Rosa spp., Cercocarpus montanus, Berberis repens, Ceanothus fendleri, Yucca glauca, Robinia neomexicana, Cowania mexicana (<5% cover).

HERBS: Well represented. Poa fendleriana, Carex geophila, C. rossii, Muhlenbergia montana, M. longiligula, Festuca arizonica (common in FEAR phase), Koeleria macrantha, Achillea millefolium, Artemisia ludoviciana, Chrysopsis villosa, Vicia americana, Poa pratensis (FEAR phase), Pteridium aquilinum (FEAR phase), Bouteloua gracilis (BOGR phase), Lotus wrightii, Antennaria parvifolia.

DIS: Widespread in NM, AZ, CO, UT.

ALSO SEE: In Arizona gambel oak can become a midstory tree with abundant or luxuriant herbs beneath. This has been described as gambel oak phases of PIPO/FEAR and PIPO/BOGR by Hanks et al (1983). Various grassy phases of PIPO/QUGA typically consist of mosaics of oaks and grasses in patchy distribution.

COMMENTS: This is a very broadly defined association, doubtless needing refinement. See TES reports and mapping units within PIPO-QUGA and PIPO-PIED-JUDE2-JUMO-QUGA subseries (USFS 1986b, 1987b).

H. T.: Ponderosa pine/Gamble oak

REGENERATION METHODS:

Clearcut: Strongly favors oak over pine.

Shelterwood: Usually successful, favors pine if enough shelter is retained to partially surpress the oak.

Seed Tree: Favors oak over pine.

Selection: Usually successful, favors pine over oak.

PLANTING:

Recommended Species: Ponderosa pine.

Success Probability: High with good site preparation.

SITE PREPARATION	INTENSITY		
Method	High	Moderate	Low
Mechanical	B	B	B
Burning	H	H	H

REVEGETATION:

STOCKABILITY: 1.0 BUDWORM SUSCEPTIBILITY: 0

TSI: Often needed to release pine from oak competition.

PRODUCTIVITY:

Site Index PIPO 47 _____ _____ Productivity Moderate

Resource Value Rating (Cattle): Early Seral Moderate Late Seral Low

OTHER: Good hiding cover in summer, browse production is often good from shrubs other than oak. Important source of mast for turkeys.

Pinus ponderosa/Quercus hypoleucoides

Ponderosa pine/Silverleaf oak 011220
PIPO/QUHY

SYN:

SITE: Elevations generally 6000-7500 ft but outside this range on special topographic sites. Climatic gradients from the Santa Catalina Mts, AZ suggest the following mean annual precipitation (MAP) and mean annual soil temperatures (MAST) based on linear regression between weather stations:

Elev-Aspect:	7000-N	6750-N	7000-S	6500-S
MAP (in/yr):	26.7	25.8	26.7	25.0
MAST (F):	48	49	50	52

Soils develop from numerous parent materials and are considered ustic and mesic in respective moisture and temperature regimes.

TES: 5,+1 HSM

TREES:

ABCO	PSME	PIST	PIPO	PIED	PIFD	PIAI	JUDE	JUOS	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM	
a	a	c	C			s	S				s	S			

SHRUBS: Well represented. Shrubby oaks (mostly Q. hypoleucoides, Q. rugosa, Q. arizonica), Rhus trilobata, Nolina microcarpa, Yucca schottii, Ceanothus fendleri, Arbutus arizonica.

HERBS: Common or well represented. Muhlenbergia longiligula, M. virescens, Aristida orcuttiana, Poa fendleriana, Carex geophila, Koeleria macrantha, Hedeoma hysssopifolium, Thalictrum fendleri, Pseudocymopteris montanus, Galium asperrimum, G. fendleri.

DIS: mostly se-AZ (Chiricahua, Pinaleno, Santa Rita, Santa Catalina, andhe Galiuro Mts) with outliers to San Carlos and Ft. Apache Res. and in NM to Brushy Mts in Glenwood RD (Gila NF).

ALSO SEE: PSME/QUHY if Douglas-fir exceeds about 10 trees/acre in mature stands Vegetation subseries PIPO-PIED-JUDE2-QUGR3-QUHY on the Glenwood RD (mapping units 5906, 5911, 5912 where MAP is reported at 21 in/yr) (USFS 1985); the ponderosa pine, oak forest between 2100-2450 m on s slopes, Santa Catalina Mts, described by Niering and Lowe (1984).

H. T. Ponderosa pine/Silverleaf oak

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually not successful	oak
SHELTERWOOD	is usually successful, best	ponderosa pine
SEED TREE	is not usually successful	oak
SELECTION	is usually successful	ponderosa pine

PLANTING

RECOMMENDED SPECIES ponderosa pine

SUCCESS PROBABILITY moderate

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak and grasses
BURNING	oak and grasses
NONE	ponderosa pine

REVEGETATION usually rapid from oak sprouting

STOCKABILITY 0.8 BUDWORM SUSCEPTABILITY 0

TSI sometimes need precommercial thinning; release may also be required.

PRODUCTIVITY

SITE INDEX $\frac{65}{\text{PIPO}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL low

OTHER This habitat type is important for deer and turkey. Large diameter oaks are important for cavity nesting birds. Large oaks cannot be reliably produced with overhead shade from pine. Can be important for fuelwood.

Pinus ponderosa/Quercus rugosa

Ponderosa pine/Netleaf oak
PIPO/QURU

011430

SYN:

SITE: Mostly 7900-8500 ft on steep upper slopes or ridgetops with shallow, rocky soils having much rock outcrop.

TES: 5,+1 or 6,-1 HSM

TREES:

ABCO	PSME	PIST	PIPO	PIED	PIFD	PIAI	JUDE	JUOS	JUMO	JUSC	QUGA	QUHY	QUAR	QUEM	QURU
a	c	C	C			c	c				s	S	s		S

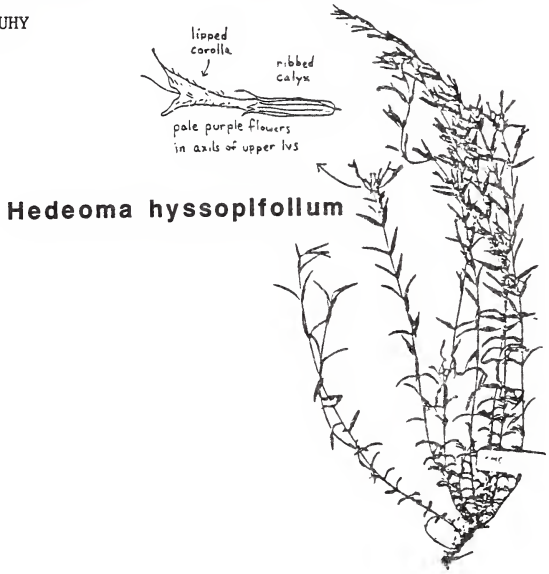
note: under PIPO is included Pinus ponderosa var arizonica (P.arizonica)

SHRUBS: abundant. Shrubby oaks: mostly Q. rugosa*, Q. hypoleucoides, Q. gambelii, Rhus trilobata, Agave parryi, Nolina microcarpa.

HERBS: poorly represented. Poa fendleriana, Muhlenbergia virescens, M. longiligula, Poas fendleriana, Koeleria macrantha, Carex geophila, Hedeoma hyssopifolium, Geranium caespitosum, Thalictrum fendleri.

DIS: se-AZ and sw-NM (Animas Mts, outliers to Mogollon Mts in Glenwood RD)

ALSO SEE: PSME/QUHY



H. T. Ponderosa pine/Netleaf oak

REGENERATION	Timber Objective	Favors
CLEARCUT	is usually unsuccessful	oak
SHELTERWOOD	is often the best method	ponderosa pine
SEED TREE	is not usually successful	oak
SELECTION	is usually successful	ponderosa pine

PLANTING

RECOMMENDED SPECIES ponderosa pine

SUCCESS PROBABILITY low

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak and other shrubs; alligator juniper, if present
BURNING	oak and other shrubs; alligator juniper, if present
NONE	ponderosa pine

REVEGETATION can be rapid with oak sprouting.

STOCKABILITY 0.7 BUDWORM SUSCEPTABILITY 0

TSI sometimes need precommercial thinning; release may also be required.

PRODUCTIVITY

SITE INDEX $\frac{55}{\text{PIPO}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER Provides browse and cover for deer. Limited potential for fuelwood.

Pinus ponderosa/Rockland

Ponderosa pine/Rockland
PIPO/Rockland

011500

SYN:

SITE: Very shallow (< 10 in.) soil and exposed bedrock comprise about 50-90 percent of the surface; 7,500-8,500 ft.

TES: 5, -1, 0, +1

TREES:

ABLA	PIEN	PIPU	POTR	ABCO	PSME	PIST	PIPO	QUGA	PIED	JUSC	JUDE	JUMO
							C		c		c	c

SHRUBS: Scarce. Quercus gambelii, Cercocarpus montanus, Yucca spp., Gutierrezia sarothrae, Fallugia paradoxa.

HERBS: Scarce to common. Muhlenbergia montana, Bouteloua curtipendula, Bouteloua hirsuta, Solidago spp., Blepharoneuron tricholepis, Schizachyrium scoparium (Andropogon scoparius).

CRYPTOGAMS:

DIS: Local in Zuni Mts., NM, Santa Catalina Mts, AZ, and elsewhere.

ALSO SEE: Malpais rockland described by Lindsey (1951) can be assigned to PIPO/Rockland.

COMMENTS: Ponderosa pine was formerly named Pinus scopulorum meaning rock pine.

Pinus engelmannii/Quercus hypoleucoides

Apache pine/Silverleaf oak 032030
PINEN/QUHY

SYN:

SITE: Lower slopes and elevated streamside terraces; 6200-7200 ft; MAP = 26 in/yr, MAST about 50 F.

TES: 5,+1 HSM

TREES:

ABCO	PSME	PIST	PIPO	PINEN	PILE	PIDI	JUDE	JUOS	JUSC	QUGA	QUHY	QUAR	QUEM	JUMA
a	c	c	c	C	c	c	c				S	s	a	s

note: PIPO includes Pinus ponderosa var arizonica (P. arizonica).

SHRUBS: scarce to well represented. shrubby Quercus spp., Yucca schottii, Rhus trilobata, Ceanothus fendleri, Garrya wrightii, Agave parryi.

HERBS: Common to well represented. Muhlenbergia longiligula, Panicum bulbosum, Aristida orcuttiana, Poa fendleriana, Hedeoma hyssopifolium

DIS: Chiricahua and Santa Rita Mts, AZ

ALSO SEE: This is one of the pine-oak woodlands generalized by Marshall (1957); Moir and Lukens (1979, plots F2 and F3 in Chiricahua Mts); Muldavin et al (1986).

Populus Angustifolia Series

Narrowleaf cottonwood forest, POAN 103xxx

This series occurs in two distinct physiognomic expressions. The deciduous aspect is characterized by dominance or codominance of Populus angustifolia. Occasionally Populus acuminata or Alnus oblongifolia will replace P. angustifolia as the dominant tree. The evergreen aspect is characterized by tall conifers such as Abies concolor, Picea pungens, Pseudotsuga menziesii, or Pinus ponderosa as leading dominants, and deciduous trees of the top canopy level are absent or infrequent.

The deciduous or mixed evergreen-deciduous forest is more extensive at elevations generally below about 8000 feet. Populus angustifolia (or sometimes P. acuminata) occur in more or less pure stands or in mixtures with the above named conifers.

Forest composition varies according to geography. Other deciduous trees often associate with the cottonwoods, including Alnus tenuifolia, A. oblongifolia, Salix amygdaloides, S. gooddingii, S. bonplandiana, Eleagnus angustifolia, Acer negundo, Quercus gambelii, Prunus spp., Juglans major, and Fraxinus pennsylvanica.

Understory shrubs can be well represented and include such species as Salix exigua, S. irrorata, S. bebbiana, Robinia neomexicana, currants (Ribes cereum, R. inerme, R. leptanthum), Amorpha fruticosa, Rhamnus betulaefolia, Rhus glabra, Rhus aromatica, Toxicodendron radicans, and species of Rosa. Understory junipers, especially Juniperus scopulorum, appear tolerant to the shade of tall deciduous trees.

Vines may be common. Species frequently encountered include Vitis arizonica, Parthenocissus inserta, Clematis ligusticifolia, and Humulus americanus

A luxuriant herb layer has numerous forbs and such grasses as Elymus glaucus, Poa pratensis, Agrostis gigantea, Agropyron smithii, A. trachycaulum, and Sporobolus spp.

This series has been described as a narrowleaf cottonwood-willow series by Brown, Lowe, and Pase (1979). The series is more or less equivalent to their digitized classifications 222.31 and 222.32. Subseries vegetation descriptions are given in various Terrestrial Ecosystem Survey (TES) reports. To date there are no descriptions at the plant association level. However, Medina (1986) described several communities dominated by Alnus oblongifolia, Populus acuminata, or Populus angustifolia in the Fort Bayard watershed, NM.

The mainly evergreen forest within this series is found mostly above about 8000 feet elevation. Cottonwood trees are absent or infrequent, and conifers such as Abies concolor, Picea pungens, and Pseudotsuga menziesii dominate. Populus tremuloides may be a common seral tree. Understories may be rich in shrubs, including Acer grandidentatum, Cornus stolonifera, Pachistima myrsinites, and species mentioned above. A luxuriant herb cover can include Heracleum sphondylium, Circaea alpina, Rudbeckia laciniata, Mertensia ciliata Hypericum formosum, Glyceria spp., Geum allepicum, Viola nephrophylla, Equisetum arvense, Scirpus microcarpus, Sidalcea neomexicana, and many other species.

The mainly evergreen aspect of this series has been described in the literature mostly at the plant association level. Published associations include Abies concolor/Galium triflorum, Abies concolor/Acer grandidentatum, Abies concolor/Juglans major, Abies concolor-Alnus oblongifolia, Picea pungens/Cornus stolonifera, and Pinus ponderosa/Poa pratensis (DeVelice et al 1986, Alexander et al 1984).

Cut-leaf coneflower
Rudbeckia laciniata

Populus Fremontii Series

Broadleafed cottonwood forest 104xxx
POFR

This series occurs mostly south of the Mogollon Rim in Arizona and in southern New Mexico (mild winter climates). Populus fremontii is usually the dominant tree, but Salix gooddingii or Salix bonplandiana may also be dominant. Other trees can include Morus microphylla, Fraxinus pennsylvanica var velutina, Juglans major, Acer negundo, Celtis reticulata, and C. pallida. Platanus wrightii may be occasional, but is not dominant (see Platanus wrightii series).

Midstory trees are mesquites (Prosopis velutina, P. glandulosa, P. pubsecens), Chilopsis linearis, Tamarix chinensis, evergreen oaks (Quercus spp.), Cercidium floridum, and Juniperus osteosperma.

Shrubs can be well represented. Species include Salix exigua, S. taxifolia, Baccharis salicifolia, Rhus aromatica, Hymenoclea monogyra, Nicotiana glauca, Acacia greggii, Tessaria sericea, Rhamnus crocea var illicifolia, Zizyphus obtusifolia, and the vine, Vitis arizonica.

Numerous species of herbs can be found. Some of the common grasses are Sporobolus airoides, Cynodon dactylon, Distichlis stricta, Bouteloua curtipendula, and Sorghum halepense. Disturbed areas or newly deposited parent materials may have sweetclovers (Melilotus alba, M. officinalis) and numerous other annuals.

This series is the common streamside or river gallery forest through grassland and deserts. It is generally equivalent to the cottonwood-willow series of Brown, Lowe, and Pase (1979, their digitized classification 224.53). It has also been identified as a Fremont cottonwood-willow community type by Laurenzi et al (1983). The series was recognized on northern portions of the Tonto National Forest (USFS 1986c).

Platanus Wrightii Series

Sycamore forests 130xxx
PLWR

Platanus wrightii dominates or is codominant in mixture with other coniferous or deciduous trees. Some of the common deciduous trees associated with the sycamore include Fraxinus pennsylvanica var velutina, Juglans major, Acer negundo, Celtis reticulata, and Alnus oblongifolia. Cottonwoods (Populus fremontii, P. angustifolia, P. acuminata depending on geography and elevation) may be occasional, but are not dominant or codominant (see the several cottonwood series).

Common vines are Vitis arizonica, Parthenocissus inserta, and Clematis ligusticifolia.

There are many associated evergreen coniferous or broadleafed trees. Depending on geography and elevation these may include such conifers as Cupressus arizonica var arizonica, Pinus ponderosa, Pinus engelmannii, Pinus leiophylla, Pseudotsuga menziesii, Pinus discolor, Pinus edulis, or Juniperus deppeana. Evergreen broadleafed trees can include several oaks (Quercus emoryi, Q. arizonica, Q. grisea, Q. hypoleucoides, Q. rugosa), and Arbutus arizonica.

Understory shrubs can be well represented. Some of the more widespread species include Amorpha fruticosa, Rhamnus betulaefolia, Toxicodendron radicans, Rhus aromatica, Salix lasiolepis, S. lutea, and Robinia neomexicana.

There is usually a diverse mixture of herbs whose cover is well represented or abundant. Among the many species are Pteridium aquilinum, Geranium caespitosum, Brickellia grandiflora, Monarda menthaefolia, Stachys coccinea, Viola canadensis, Smilacina spp., Melilotus officinalis, M. alba, Piptochaetium fimbriatum, Cynodon dactylon, Elymus glaucus, and species of Penstemon. But herbaceous composition is highly variable from one area to another.

This series is equivalent to the sycamore series (223.22) of Brown, Lowe, and Pase (1979). Subseries descriptions are locally available in TES reports at some Ranger Districts. There are no published plant associations.

WOODLANDS

Pinus fallax/Arctostaphylos pungens

20W

Scarp Woodland

1W

250000

SITE: Slopes > 40 percent with cobbly, bouldery soils having much discontinuity because of rock outcrop or bare rock exposure.

TES: 4; -1, 0, +1.

TREES: Well represented. Species composition varies with geography and elevation.

SHRUBS: Well represented. Usually numerous species are found. Composition varies with geography and elevation.

HERBS: Well represented. Numerous species of both grasses and forbs.

DIS: Widespread in Southwest and Great Plains.

ALSO SEE: QUGR/CEMO, PIED/CEMO, JUMO/QUTU, JUMO/QUUN, JUDE-JUMO/CEMO-QUGR (USFS 1986a); TES mapping units with very steep slopes and rock outcrop components, such as mapping unit 278 (USFS 1986b).

COMMENTS: Steep, rough, topography limit management opportunities to wildlife, visual, and dispersed recreation rather than extractive, commodity-oriented use.

Quercus oblongifolia/mixed Bouteloua

Mexican blue oak/mixed grama 610010
QUOB/BOUTELOUA

SYN:

SITE: Alluvial soils of valley plains and coalescent piedmont fans, lower slopes and toeslopes of mixed alluvium-colluvium; 4500-5300 ft; MAP 17 in/yr, MAAT 57 F.

TES: 4 -1 HSM

TREES: Well represented. Quercus oblongifolia* is dominant, sometimes with occasional Quercus arizonica, Q. emoryi, or Juniperus deppeana. Pinus discolor ranges from absent to occasional. Trees at maturity are often 20-25 ft. tall.

SHRUBS: Scarce to common. For list see QUEM/BOCU.

HERBS: Abundant. Bouteloua gracilis, Bouteloua hirsuta, Bouteloua chondrosioides, Bouteloua curtipendula, Bouteloua eriopoda, Aristida ternipes, Aristida divaricata, Eragrostis intermedia, Bothriochloa barbinodis, Lycurus phleoides, Commelina dianthifolia, Evolvulus spp., and numerous other forbs.

DIS: se AZ in portions of Coronado NF.

ALSO SEE: Bonham 1972 (association 5), Niering and Lowe 1984, open encinal in Lowe (1964), Whittaker and Niering (1965).

3W

Quercus oblongifolia/Dasylirion wheeleri

Mexican blue oak/Sotol 610020
QUOB/DAWH

SYN:

SITE: mountain and hill slopes, mostly 15-80%, on a variety of colluvial soils, 4300-5800 ft; MAP 17 in/yr, MAAT 56-58 F, about 55% of precipitation occurs from October through March, May and June are hot, dry months. Climatic analysis on the south slopes of the Santa Catalina Mts, AZ gives the following gradient (from unpublished TES notes):

Elev (ft):	4250	4750
MAP (in/yr):	17.2	18.9
MAST (F):	61	59

TES: 4 -1 HSM

TREES: Well represented. Quercus oblongifolia*, Quercus emoryi, occasional Juniperus deppeana. Trees are mostly of low stature (10-16 ft tall).

SHRUBS: Common Nolina microcarpa, Yucca schottii, Eriogonum wrightii, Garrya wrightii, Rhus trilobata, Ericameria laricifolius, Mimosa biuncifera, Acacia constricta, Prosopis velutina, Agave schottii, Agave palmeri.

HERBS: Well represented to abundant. Schizachyrium cirratum, Aristida ternipes, Bouteloua curtipendula, Muhlenbergia emersleyi, Eragrostis intermedia, Bouteloua gracilis, Bouteloua radicosa, Bouteloua eriopoda Bothriochloa barbinodis, and numerous forbs.

DIS: se AZ in portions of Coronado NF.

ALSO SEE: Niering and Lowe 1984, Whittaker and Niering 1965.

Quercus grisea/Bouteloua curtipendula

4W

Gray oak/Sideoats grama
QUGR/BOCU

630010

SYN:

SITE: Piedmont hills, canyon bottoms, coalescent alluvial fans, and canyon slopes generally between 5500-6500 ft. At lower elevations best woodland development occurs in canyon bottoms along intermittent washes (often Typic Ustifluvents); on slopes woodlands grade with elevation into chaparral where soils are shallow, rocky, and erosional MAP 19 in/yr, MAAT 55 F.

TES: 4,0,-1 HSM

TREES: Well represented (drier sites) to luxuriant (canyon bottoms). Quercus grisea, Juniperus deppeana, J. monosperma, Pinus edulis, Pinus discolor (locally).

SHRUBS: Common or well represented. Cercocarpus breviflorus, shrubby oaks (Quercus grisea and hybrids to Q. turbinella), Nolina microcarpa, Dasylirion wheeleri, Yucca baccata, Mimosa biuncifera, Rhus trilobata, and along washes (Typic Ustifluvents) Fallugia paradoxa, Lonicera albiflora, Brickellia californica.

HERBS: Well represented or abundant. Bouteloua curtipendula, B. eriopoda, B. gracilis, Muhlenbergia emersleyi, M. longiligula, Eragrostis intermedia, Schizachyrium cirratum, Aristida orcuttiana, Lycurus phleoides, Poa fendleriana, Koeleria macrantha, Sitanion hystrix, Carex geophila, Artemisia carruthii, Galium microphyllum, Geranium caespitosum, Phaseolus spp., and numerous other forbs.

DIS: s NM; local in se AZ (Apache NF, Clifton RD)

ALSO SEE: TES mapping units 3828, 4835, 4946, 4969, 4970 on portions of the Glenwood RD (Gila NF) indicated as PIED-JUDE2-QUGR3, PIED-JUDE2-JUMO-JUOS-QUGR2, and PIED-JUDE2-QUGR3-QUHY subseries (USFS 1985). QUAR/MUEM and QUAR/RHTR are also similar. Medina (1987) describes a Quercus grisea community type at Ft Bayard, NM that can perhaps be assigned to QUGR/BOCU. This complex association needs further study.

NOTES: At lower elevations QUGR/BOCU can grade to desert grassland. The savanna or open woodland begins with about 5% canopy of combined oak and juniper. At higher elevations tree coverage can increase to 40-50% and includes mixes of oak, juniper, and pinyon. However, Quercus grisea (as a tree) is always well represented.

5W

Quercus grisea/Cercocarpus montanus

Gray oak/Mountain mahogany 630020
QUGR/CEMO

SYN:

SITE: 6000-6800 ft. on shallow, erosional soils of ridgetops, upper slopes, scarps, or toeslopes.

TES: 4,-1,0,+1 HSM

TREES: Well represented. Quercus grisea, Pinus edulis (4,0,+1), Juniperus deppeana, J. monosperma.

SHRUBS: Abundant. Cercocarpus montanus (including var paucidentata (C. breviflorus)), Garrya wrightii, Rhus trilobata, Nolina microcarpa, Agave parryi, Opuntia phaeacantha, O. spinosior, Yucca baccata.

HERBS: Typically scarce because of strong tree and shrub dominance. Bouteloua curtipendula, Aristida spp., Bouteloua gracilis, Poa fendleriana, Muhlenbergia longiligula, Pedicularis centranthera, Artemisia ludoviciana, and occasional other forbs.

DIS: s NM and se AZ.

ALSO SEE: Medina (1987), scarp woodland, mapping unit 4910 for TES in Glenwood RD of the Gila NF. PIED/CEMO, Quercus grisea phase (204032 in USFS 1986a) is very similar, but the oak is generally shrubby.

Quercus emoryi/Arctostaphylos pungens

Emory oak/Manzanita 620010
QUEM/ARPU

SYN:

SITE: 4200-5600 ft; often Lithic Ustorthents on very shallow granitics or rhyolites, or Typic and Lithic Ustochrepts on other, mixed parent materials (see TES reports); MAP 20-22 in/yr; May and June are hot and dry.

TES: 4,-1,0 HSM/LSM

TREES: Well represented. Scattered, low (8-12 ft tall) Quercus emoryi, Q. arizonica, Juniperus deppeana, Pinus discolor (HSM climate) or Pinus, fallax (LSM), and infrequent Juniperus erythrocarpa. (usually associated with PIFA phase), Arbutus arizonica (se AZ).

SHRUBS: Abundant. Arctostaphylos pungens*, A. pringlei, Garrya wrightii, Cercocarpus montanus, Quercus turbinella, Rhus trilobata, Mimosa biuncifera, and a scattering of Dasylirion wheeleri, Agave palmeri, Yucca schottii, Y. baccata, Nolina microcarpa, Opuntia phaeacantha, Rhamnus crocaea.

HERBS: Scarce or common. Andropogon cirratus, Muhlenbergia emersleyi, Aristida orcuttiana, Aristida arizonica, Aristida spp., Bouteloua gracilis, B. curtipendula, Eragrostis intermedia, scattered forbs.

DIS: sw-NM and s-AZ below the Mogollon Rim.

ALSO SEE: QUEM/ARPU intergrades to QUEM/DAWH or QUAR/MUEM (both woodland savannas) as soils become deeper or less erosional and to PIFA/ARPU at higher elevations. On northern portions of the Tonto NF see map units 3752, 3753, and 4242 of the Terrestrial Ecosystem Survey (USFS 1986c); see MUs 4366 and 4439 for the Globe RD (USFS 1984).

NOTE: Recent or frequent past fires would reduce the conifers and increase shrub components. Vegetation would resemble chaparral.

H. T. Emory oak/Manzanita

REGENERATION

CLEARCUT	favors oak and manzanita
SHELTERWOOD	favors oak
SEED TREE	favors and manzanita
SELECTION	favors oak

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL *	oak and manzanita
BURNING	oak and manzanita
NONE	oak and manzanita

REVEGETATION rapid because of the sprouting characteristics

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER Livestock grazing potential is low.

* See TES reports for limitations due to shallow or rocky soils, or high erosion potentials.

Quercus emoryi/Bouteloua curtipendula

Emoryi oak/Sideoats grama — typic phase 620020
QUEM/BOCU — Nolina microcarpa phase 620021

SYN:

SITE: Deep, well drained soils of basin fill alluvium, depositional soils of ephemeral streams and washes, piedmont alluvial fans, toeslopes of mixed alluvial-colluvial parent materials, hills, and residual soils of rhyolitic pediments and elevated plains; mostly 5000-5400 ft, but as low as 4500 ft; MAP 17 in/yr, MAAT 57 F; severe drought in May and June.

TES: 4 -1 HSM

TREES: Well represented. Savannas of Quercus emoryi dominant or codominant with Quercus arizonica (or hybrids to Q. grisea), Juniperus deppeana, Juniperus erythrocarpa, and sometimes occasional Pinus discolor.

SHRUBS: Common (typic phase) to well represented (NOMI phase). Nolina microcarpa, Garrya wrightii, Rhus trilobata, Ericameria laricifolius, Mimosa biuncifera, Acacia constricta, Arctostaphylos pungens, Eriogonum wrightii, Yucca schottii, Prosopis juliflora.

HERBS: Well represented to abundant. Schizachyrium cirratum, Aristida orcuttiana, Bouteloua curtipendula, Muhlenbergia emersleyi, Eragrostis intermedia, Bouteloua gracilis, Lycurus phleoides, Piptochaetium fimbriatum, Koeleria macrantha, Phaseolus spp., Desmodium spp, Leucelene ericoides, Artemisia carruthii, Sphaeralcea spp.

DIS: sw NM, se and sc AZ mostly south of the Mogollon Rim.

ALSO SEE: Bonham 1972, Moir 1979, Wagner 1977; Quercus emoryi-Nolina microcarpa-Bouteloua curtipendula h.t. (Willging 1987); both QUAR/MUEM and QUEM/DAWH are also "open encinal" or oak woodland savannas, but generally of colluvial mountain and hill slopes. QUEM/BOCU intergrades to QUAR/PIFI along washes at higher elevations.

NOTE: Reported as important habitat for Gould's turkey in sw NM (Willging 1987), also good habitat for Mearn's quail. Effects of a single grass fire upon woody species was described by Johnson et al (1962).

Quercus emoryi/Dasylirion wheeleri

8W

Emoryi oak/Sotol
QUEM/DAWH

620030

SYN:

SITE: mountain and hill slopes, mostly 15-80%, on a variety of colluvial soils, 4300-5800 ft; MAP 17 in/yr, MAAT 56-58 F, about 55% of precipitation occurs from October through March, May and June are hot, dry months.

TES: 4 -1 HSM

TREES: Well represented. Quercus emoryi is dominant. Common or occasional trees include Quercus arizonica (including hybrids to Q. grisea), Juniperus deppeana, Pinus discolor. Trees are mostly of low stature (10-16 ft tall).

SHRUBS: Common Nolina microcarpa, Yucca schottii, Eriogonum wrightii, Garrya wrightii, Rhus trilobata, Ericameria laricifolius, Mimosa biuncifera, Acacia constricta, Arctostaphylos pungens,

HERBS: Well represented to abundant. Schizachyrium cirratum, Aristida orcuttiana, Bouteloua curtipendula, Muhlenbergia emersleyi, Eragrostis intermedia, Bouteloua gracilis, Lycurus phleoides, Piptochaetium fimbriatum, Koeleria macrantha, Phaseolus spp., Desmodium spp, Leucelene ericoides, Artemisia carruthii, Sphaeralcea spp.

DIS: sw NM, se and sc AZ mostly south of the Mogollon Rim.

ALSO SEE: QUEM/BOCU on generally alluvial soils with greater tree productivity (see TES reports); Wallmo 1955, Wentworth 1981, Shreve 1915; Quercus emoryi-Pinus discolor/Mimosa biuncifera community type Medina (1987).

9W

Quercus emoryi/Juglans major

Emory oak/Walnut
QUEM/JUMA

620040

SYN: Quercus emoryi/Vitis arizonica (Willging 1987)

SITE: Wash margins and upper terraces of intermittent drainages, 5000-6000 ft elevation; Fluventic Ustochrepts and Typic Ustifluvents are common soils (see TES reports and verify on-site soils).

TES: 4, -1,0,+1 HSM and LSM

TREES: Abundant or luxuriant. Quercus emoryi, Q. arizonica, Q. grisea, Juglans major*, Juniperus spp. (depending on geography), Pinus discolor, Pinus fallax, Pinus edulis (pinyon pines depending on geography), Prunus spp., Celtis reticulata.

SHRUBS: Well represented. Rhus trilobata, Fallugia paradoxa, Mimosa biuncifera, Chrysothamnus nauseosus, Lonicera albiflora, Toxicodendron radicans, Berberis haematocarpa, B. willcoxii. Vines can include Vitis arizonica and Parthenocissus inserta.

HERBS: Usually abundant. Bouteloua curtipendula, B. gracilis, Leptochloa dubia, Piptochaetium fimbriatum, Muhlenbergia emersleyi, Muhlenbergia rigens, Panicum bulbosum, Koeleria macrantha, Poa fendlerana, Andropogon cirratus, A. barbinodis, Artemisia carruthii and numerous other species of forbs (high diversity).

DIS: sw-NM and AZ mostly south of the Mogollon Rim.

ALSO SEE: Riparian forests. QUEM/JUMA differs from riparian forests by lacking tall, deciduous trees such as cottonwoods and sycamores as well as lacking willows and alders.

NOTE: Soils may be influenced by overland flow of water but are rarely flooded. Recharge of soil water is by direct precipitation plus some overland flow. Water table, however, is well below rooting depths and is not appreciably elevated by infrequent water drainage in the adjoining channels. Where overland flow produces a greater amount of soil water, the emory oaks attain greater heights (up to 30-40 ft).

H. T. Emory oak/Walnut

REGENERATION *

CLEARCUT	favors oak
SHELTERWOOD	favors oak
SEED TREE	favors oak
SELECTION	favors oak

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak
BURNING	oak
NONE	oak

REVEGETATION moderate to rapid

PRODUCTIVITY

SITE INDEX Moderate to high (for Emory oak)

FORAGE VALUE RATING (CATTLE): EARLY SERAL high LATE SERAL moderate

OTHER Provides browse and cover for deer and turkey. Very high potential for fuelwood, easy to reproduce oak successfully. Oaks support numerous cavity dwelling animals.

* Walnut management is yet poorly understood.

Quercus arizonica/Muhlenbergia emersleyi

10W

Arizona white oak/Bullgrass 630030
QUAR/MUEM

SYN:

SITE: Canyon and piedmont hill slopes, 4800-6200 ft; MAP 19 in/yr, MAAT 55 F, dry season May and June; highly variable parent materials and soils.

TES: 4,0 HSM.

TREES: Well represented. Quercus arizonica is dominant, Quercus emoryi, Juniperus deppeana, Pinus discolor; Quercus hypoleucoides (<5% cover when present). See note below.

SHRUBS: Common or well represented. Garrya wrightii, Nolina microcarpa, Rhus trilobata, Dasylirion wheeleri, Agave palmeri, Yucca schottii, Ericameria laricifolius, Cercocarpus breviflorus, Mimosa biuncifera, Arctostaphylos pungens, Acacia angustissima, Choisya arizonica, Opuntia spinosior.

HERBS: Well represented to abundant. Schizachyrium cirratum, Aristida orcuttiana, Bouteloua curtipendula, Muhlenbergia emersleyi, Eragrostis intermedia, Bouteloua gracilis, Lycurus phleoides, Piptochaetium fimbriatum, Panicum bulbosum, Phaseolus spp., Desmodium spp, and numerous other forbs.

DIS: Extreme sw NM (Animas, Peloncillo, Burro Mts) and se AZ.

ALSO SEE: Open oak woodland (lower encinal) of Whittaker and Niering (1965) and Wagner (1977); Arizona white oak savanna (Moir 1979, Wallmo 1955). QUGR/BOCU (USFS 1986a) mostly in s NM is very similar but lacks some of the Madrean plant species of QUAR/MUEM. In the Glenwood RD see Terrestrial Ecosystem Survey map units 4836 and 4850 (USFS 1985).

NOTE: In canyon bottoms trees often become more dense and taller (cover is abundant or luxuriant). This woodland is sometimes called closed encinal or canyon oak woodland (see citations above). Some additional shrubs and herbs of canyon oak woodlands include Fallugia paradoxa, Brickellia californica, Lonicera albiflora, Anisacanthus thurberi, and Leptochloa dubia (occasional on drier slopes).

Quercus arizonica/Piptochaetium fimbriatum

11W

Arizona white oak/Pinyon ricegrass 630050
QUAR/PIFI

SYN: Pinus edulis-Quercus arizonica/Piptochaetium fimbriatum (USFS 1986a).

SITE: Deep alluvium along dry washes (cumulic and fluventic soils), 5400-5800 ft.

TES: 4 O HSM

TREES: Luxuriant. Often tall (>20 ft) Quercus arizonica, Q. emoryi, Juniperus deppeana, Pinus discolor (in some locations P. edulis), and occasional Juglans major. Quercus grisea replaces Q. arizonica in some areas.

SHRUBS: Well represented. Chrysothamnus nauseosus, Rhus trilobata, Vitis arizonica, Arctostaphylos pungens, Garrya wrightii, Nolina microcarpa, Gutierrezia sarothrae.

HERBS: Usually abundant. Piptochaetium fimbriatum, Bromus anomalous, Aristida orcuttiana, Poa fendleriana, Koeleria macrantha, Muhlenbergia longiligula, M. emersleyi, M. rigens, Bouteloua curtipendula, B. gracilis, Schizachyrium cirratum, Artemisia ludoviciana, A. carruthii, Phaseolus.

DIS: Local in sw NM and south of the Mogollon Rim in AZ.

ALSO SEE: QUEM/JUMA on similar sites at lower elevations; Cumulic Haplustolls component of map unit 4836 in Terrestrial Ecosystem Survey for part of the Glenwood RD (USFS 1985). If Platanus wrightii is common, see riparian forests. QUAR/PIFI intergrades to QUAR/MUEM on certain soils.

Quercus arizonica/Rhus trilobata

White oak/Skunkbush, Gray oak/Skunkbush
QUAR/RHTR

JUDE phase 630041
JUMO phase 630042
PIFA phase 630043

SYN: Pinus edulis-Quercus arizonica/Rhus trilobata (USFS 1986a)

SITE: 5000-7000 ft on wide variety of landforms, parent materials, and soils. MAP about 19 in/yr, MAAT about 54 F.

TES: 4,0 HSM (JUMO phase); 4,+1 HSM (JUDE phase); 4,+1 LSM (PIFA phase).

TREES: Abundant to luxuriant. Quercus arizonica, Quercus grisea (and its hybrids to Q. arizonica), Quercus emoryi, Pinus edulis (HSM climates), Pinus fallax (LSM), Juniperus deppeana, J. monosperma, J. osteosperma (usually associated with PIFA phase), Arbutus arizonica (se AZ).

SHRUBS: Well represented. Rhus trilobata, Nolina microcarpa, Garrya wrightii, Cercocarpus montanus, Ceanothus greggii, Dasylirion wheeleri, Yucca schottii, Y. baccata, Opuntia phaeacantha, Opuntia spp., Ceanothus fendleri, Rhus coriophylla, Eriogonum wrightii, Agave parryi.

HERBS: Poorly represented. Schizachyrium cirratum, Calliandra humilis, Aristida orcuttiana, Aristida arizonica, Aristida spp., Piptochaetium fimbriatum, Bouteloua gracilis, B. curtipendula, Muhlenbergia emersleyi, Eragrostis intermedia, Phaseolus spp., Artemisia spp.

DIS: s-NM and AZ south of the Mogollon Rim.

ALSO SEE: Encinal woodlands, Madrean oak woodlands. The pine-oak woodlands of Marshall (1957) feature emergent pines (Pinus leiophylla, P. engelmannii, P. ponderosa) above the upper oak canopy. The QUAR/MUEM h.t is a grassy savanna (open encinal), whereas QUAR/RHTR is more a closed woodland with reduced herbaceous understory. See also the canyon oak woodlands (e.g. Moir 1979). In the Clifton RD (Apache NF) see TES mapping units (MUs) 236, 575, 612, 620, 630, 632, 634 of the PIED-JUDE2-JUMO-QUGR3 subseries; MUs 130 and 154 of this subseries can also be regarded as containing scarp woodland (USFS 1987b).

H. T. White oak/Skunkbush Gray oak/Skunkbush

REGENERATION

CLEARCUT	favors oak and skunkbush
SHELTERWOOD	favors oak
SEED TREE	favors oak and skunkbush
SELECTION	favors oak

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak
BURNING	oak
NONE	oak

REVEGETATION rapid due to the sprouting of oak

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL low

OTHER Productive for deer browse. Good potential for hiding cover.

Quercus hypoleucoides/Muhlenbergia longiligula

Silverleaf oak/Longtongue muhly 650010
QUHY/MULO

SYN:

SITE: Canyons 6000-6500 ft., often Typic Ustifluvents; and mountain slopes to about 7500 ft on a variety of soils on residual or colluvial parent materials; MAP 20-21 in/yr, MAAT about 53 F with relatively mild winters. Climatic analysis on the north slopes of the Santa Catalina Mts, AZ gives the following gradient (from unpublished TES notes):

Elev (ft):	6000	6500
MAP (in/yr):	23.2	25.0
MAST (F):	52	50

TES: 4 +1 HSM

TREES: Luxuriant. Quercus hypoleucoides*, Quercus arizonica, Juniperus deppeana, and occasionally Pinus discolor and Arbutus arizonica.

SHRUBS: Well represented. Quercus rugosa, Nolina microcarpa, Garrya wrightii, Rhus trilobata, Ericameria laricifolius, Agave parryi, Quercus gambelii.

HERBS: Usually poorly represented. Muhlenbergia longiligula, Aristida orcuttiana, Bouteloua curtipendula, Koeleria macrantha, Agropyron arizonicum, Bromus lanatipes, Bromus ciliatus, Poa fendleriana, Muhlenbergia emersleyi (lower elevations), Hedeoma hyssopifolium, Geranium caespitosum, Thalictrum fendleri.

DIS: extreme sw NM (Animas Mts) with outliers to Brushy Mts (Glenwood RD of Gila NF); se AZ.

ALSO SEE: TES mapping unit 4970 on Glenwood RD (USFS 1985); Wagner 1977; Moir and Lukens 1976 (plot F5 at Chiricahua National Monument, AZ); upper encinal of Lowe 1964; PIDI/QUHY is a chaparralic woodland of shallow, rocky soils.

NOTES: QUHY/MULO differs from published descriptions of pine-oak woodlands (Marshall 1957, Niering and Lowe 1984, Whittaker and Niering 1965) by absence of taller, emergent pines above the oak-juniper-pinyon canopy level. However, fires within PIPO/QUHY, PILE/QUHY, and PSME/QUHY h.t.s can bring about a successional stage resembling QUHY/MULO woodland. Wagner (1977) refers to such a fire in the Animas Mts, NM.

Pinus discolor/Choisya arizonica

Border pinyon/Star-leaf 232020
PIDI/CHAR

SYN: Pinus discolor-Quercus arizonica/Nolina microcarpa (ed.1, Moir and Carleton 1987).

SITE: Steep n slopes around 6500 ft; limestone and altered limestone parent materials; MAP 20 in/yr.

TES: 4 +1 HSM

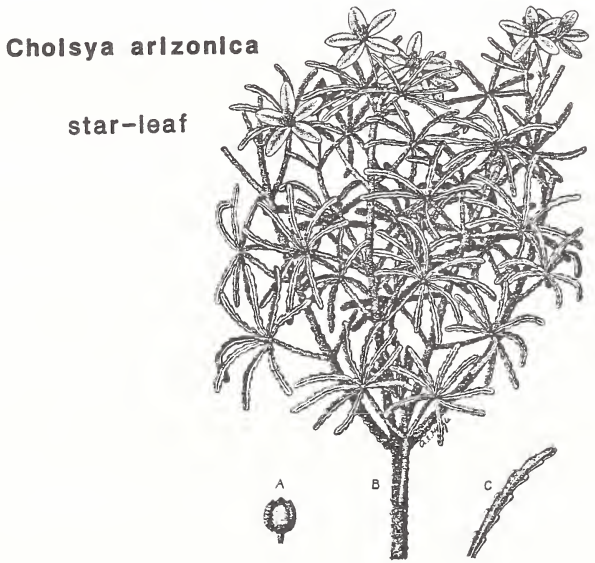
TREES: Luxuriant. Pinus discolor(C), Juniperus deppeana(c), occasional Quercus arizonica (S).

SHRUBS: Common to well represented. Choisya arizonica*, Garrya wrightii, Rhus trilobata, Fendlera rupicola, Cercocarpus breviflorus, Nolina microcarpa, Ptelea trifoliata, Opuntia spinosior.

HERBS: Scarce to common. Bouteloua gracilis, B. curtipendula, Koeleria macrantha, Cheilanthes fendleri, Thlaspi alpestre.

DIS: se AZ (so far, sampled only in Dragoon Mts).

ALSO SEE:



Pinus discolor/Muhlenbergia emersleyi

Border pinyon/Bullgrass 232030
PIDI/MUEM

SYN:

SITE: Usually moderate to steep n colluvial slopes 5800-6600 ft; soils are erosional and may be very shallow (< 5 in) and interrupted by exposed bedrock. MAP 18-19 in/yr.

TES: 4 0,+1 HSM

TREES: Well represented. Pinus discolor, Juniperus deppeana, occasional Quercus arizonica (or hybrids to Q. grisea) and Q. emoryi (but total oak cover is scarce).

SHRUBS: Common. Quercus toumeyi, Q. toumeyi x grisea, Q. grisea (shrubby), Garrya wrightii, Rhus trilobata, Fendlera rupicola, Cercocarpus breviflorus, Nolina microcarpa, Dasylirion wheeleri, Gymnosperma glutinosum, Yucca schottii, Y. baccata, Gutierrezia sarothrae, Arctostaphylos pungens.

HERBS: Well represented. Bouteloua gracilis, B. curtipendula, B. repens, Eragrostis intermedia, Muhlenbergia emersleyi, M. monticola, Koeleria macrantha, Bromus anomalous, Sitanion hystrix, Schizachyrium cirratum, ferns (e.g. Cheilanthes, Bommeria, Pellaea).

DIS: sw NM, se AZ

ALSO SEE: Moir (1979), Pinus discolor-Nolina microcarpa-Muhlenbergia emersleyi h.t. of Willging (1987). On shallow, rocky soils of the southern Peloncillos, NM PIDI/MUEM and QUEM/ARPU form complicated mosaics and gradational associations.

NOTE: Important habitat for Gould's turkey (Willging 1987).

Pinus discolor/Piptochaetium fimbriatum

16W

Border pinyon/Pinyon ricegrass
PIDI/PIFI

232040

SYN:

SITE: Washes and drainageways (Typic Ustifluvents and Cumulic and Typic Ustochrepts), and n slopes, 5500-6000 ft.; MAP 18-19 in/yr.

TES: 4 0,+1 HSM

TREES: Abundant. Pinus discolor, Juniperus deppeana, occasional Quercus grisea (or hybrids to Q. arizonica).

SHRUBS: Common. Quercus toumeyi, Q. toumeyi x grisea, Q. grisea (shrubby), Garrya wrightii, Rhus trilobata, Fendlera rupicola, Cercocarpus breviflorus, Nolina microcarpa, Yucca schottii, Y. baccata, Gutierrezia sarothrae, Opuntia phaeacantha, Arctostaphylos pungens.

HERBS: Well represented. Bouteloua gracilis, B. curtipendula, Piptochaetium fimbriatum, Eragrostis intermedia, Muhlenbergia emersleyi, Koeleria macrantha, Bromus anomalous, Sitanion hystrix, Schizachyrium cirratum, Allium kunthii, Senecio neomexicanus, Phaseolus spp.

DIS: sw NM, se AZ

ALSO SEE: PIDI/MUEM is mostly on colluvial slopes and Piptochaetium is poorly represented in the grass assemblage. There is very little description of PIDI/PIFI at present. Importance of PIDI/PIFI to Gould's turkey habitat is discussed by Willging (1987).

Pinus discolor/Quercus toumeyi

Border pinyon/Toumey oak 232050
PIDI/QUTO

SYN:

SITE: Rhyolite parent materials, 5900-6100 ft; MAP 19 in/yr, MAAT 58 F;

TES: 4 0 HSM

TREES: Well represented. Pinus discolor, Juniperus deppeana, J. erythrocarpa occasional Quercus emoryi.

SHRUBS: Abundant. Quercus toumeyi*, Q. toumeyi x grisea, Arctostaphylos pungens, Garrya wrightii, Rhus trilobata, Rhus coriophylla, Nolina microcarpa, Yucca schottii, Agave palmeri, Dasylirion wheeleri.

HERBS: Scarce to common. For list see QUAR/MUEM.

DIS: extreme sw NM, se AZ

ALSO SEE: Smith 1974, chaparral woodland in Moir 1979, the shrubby element of Willging's (1987) Pinus discolor-Quercus toumeyi-Muhlenbergia emersleyi habitat type. PIFA/ARPU occurs in LSM climates elsewhere s of the Mogollon Rim.

Garrya wrightii

Wright's silktassel

Pinus discolor/Quercus hypoleucoides

Border pinyon/Silverleaf oak
PIDI/QUHY

232060

SYN:

SITE: Steep upper slopes and ridgetops or elevated plains 6200-7000 ft; soils extremely rocky, or shallow and rocky, often broken by rock outcrop. For climatic parameters see QUHY/MULO.

TES: 4 +1 HSM

TREES: Well represented. Pinus discolor, Juniperus deppeana, Pinus ponderosa (accidental or occasional), Pinus leiophylla (accidental or occasional).

SHRUBS: Abundant. Quercus hypoleucoides, Quercus rugosa, Nolina microcarpa, Arctostaphylos pringlei, A. pungens, Garrya wrightii, Agave parryi, Rhus trilobata, Quercus gambelii.

HERBS: Scarce. For list see QUHY/MULO.

DIS: extreme sw NM (Animas Mts); se AZ (Chiricahua and Santa Catalina Mts).

ALSO SEE: Pygmy conifer, oak scrub described by Niering and Lowe (1984); Wagner 1977. Otherwise a poorly described association.

Pinus discolor/Rhus coriophylla

19W

Border pinyon/Leatherleaf sumac 232070
PIDI/RHCO

SYN: Pinus discolor/Cercocarpus breviflorus-Rhus coriophylla (ed.1)

SITE: 5500 on n slopes to 6500 on s slopes; limestone parent materials; MAP 19 in/yr, MAAT 55 F, mean January air temperature 46 F (Ft. Huachuca).

TES: 4 0 HSM

TREES: Well represented. Pinus discolor, Juniperus erythrocarpa

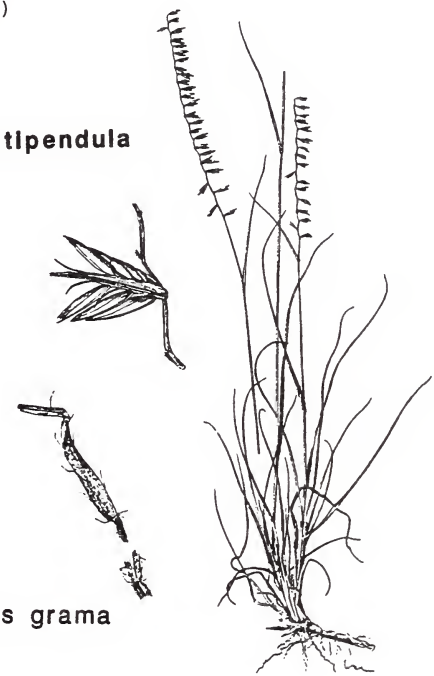
SHRUBS: Well represented to abundant. Cercocarpus breviflorus, Rhus coriophylla, Dasylirion wheeleri, Fendlerella utahensis, Garrya wrightii.

HERBS: Well represented. Bouteloua gracilis, B. curtipendula, B. repens, Eragrostis intermedia, Muhlenbergia emersleyi, Stipa (reported as S. lettermannii in Wentworth 1985), ferns (e.g. Cheilanthes, Bommeria, Pellaea, Notholaena).

DIS: se AZ (Mule Mts, Huachuca Mts)

ALSO SEE: Wentworth (1981, 1985).

Bouteloua curtipendula



sideoats grama

Pinus fallax/Arctostaphylos pungens

20W

Arizona pinyon/manzanita 233010
PIFA/ARPU

SYN: Pinus monophylla/Quercus turbinella-Arctostaphylos pungens (Moir and Carleton 1987).

SITE: Elevations mostly between 4800-6000 ft on a wide variety of slopes, aspects, landforms, and soils. MAP about 20 in/yr with hot, dry season during May and June.

TES: 4,0,+1 LSM

TREES: Well represented or abundant. Pinus fallax, Juniperus osteosperma, Juniperus deppeana, Quercus emoryi (<5% cover when present).

SHRUBS: Abundant or luxuriant. Arctostaphylos pungens, Quercus turbinella, Mimosa biuncifera, Nolina microcarpa, Rhus trilobata, R. ovata, Garrya wrightii, G. flavescens, Berberis haematocarpa, Menodora scabra, Ceanothus greggii, Cowania stansburiana v. mexicana (calcareous soils), Cercocarpus montanus, Gutierrezia sarothrae

HERBS: Scarce to well represented. Bouteloua curtipendula, B. hirsuta, Hilaria belangeri, Poa fendleriana, Koeleria macrantha, Stipa neomexicana, S. speciosa, Oryzopsis hymenoides, Sitanion hystrix, Melampodium leucanthum, Pedicularis centranthera, Leucelene ericoides, Eriogonum wrightii.

DIS: c-AZ below Rim north in Oak Creek Canyon to Sedona.

ALSO SEE: TES subseries PIMO/JUOS/QUTU2/ARPU on the northern portion of Tonto NF (USFS 1986c). The modal mapping unit (MU) is MU 3730 (erosional soils on diabase). Other MUs include 3731, 3710 (Typic Haplustalfs, deep gravelly loam, 15-40% slopes), 3752 and 3753 (Typic Ustochrepts, very deep gravelly loams on mixed parent materials and granitics). This subseries was also described in the TES report for the Globe RD: MUs 3705, 3765, 4038, 4768, and 4820 (USFS 1984). PIED/ARPU is also similar, and may occur in southern portions of the Gila, Apache, and Coconino NFs.

NOTE: Warmer, drier sites may feature PIED/QUTU (Arctostaphylos pungens scarce or absent), juniper woodlands, or chaparral. Colder or wetter sites may have ponderosa pine or Arizona cypress h.t.s.

H. T. Arizona pinyon/Manzanita

REGENERATION

CLEARCUT favors grasses, shrubs, and alligator juniper, if present

SHELTERWOOD favors Arizona pinyon with light cuttings

SEED TREE favors grasses or shrubs

SELECTION favors Arizona pinyon

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	shrub species
BURNING	shrub species
NONE	Arizona pinyon

REVEGETATION moderately rapid due to resprouting of shrubs

PRODUCTIVITY

SITE INDEX $\frac{25}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL none

OTHER This habitat type has good potential for browse production and for hiding cover.

Pinus fallax/Bouteloua gracilis

Arizona pinyon/Blue grama
PIFA/BOGR

Juniperus deppeana phase 233020
Juniperus osteosperma ph. 233021

SYN:

SITE: Elevated plains and alluvial valley plains,4900-5600 ft.; MAP around 22 in/yr, MAAT 52-56 F.

TES: 4,+1 LSM (JUDE phase); 4,0 LSM (JUOS phase)

TREES: Abundant. Pinus fallax, Juniperus osteosperma, J. deppeana, and sometimes occasional or common Quercus emoryi or Q. arizonica.

SHRUBS: scarce to common. Quercus turbinella, Nolina microcarpa, Berberis haematocarpa, B. fremontii, Cowania stansburiana var mexicana, Opuntia spp., Gutierrezia sarothrae, Eriogonum wrightii.

HERBS: abundant. Bouteloua gracilis, B. curtipendula, B. hirsuta, B.eriopoda, Aristida longiseta, Aristida spp., Sporobolus cryptandrus, Lycurus phleoides, Bothriochloa barbinodis, Schizachyrium scoparium, Hilaria belangeri, Koeleria macrantha, Poa fendleriana, Sitanion hystrix, Stipa spp., Agropyron smithii, numerous forbs.

DIS: c-AZ south of the Mogollon Rim (Prescott and Tonto NFs, Ft Apache).

ALSO SEE: TES mapping unit 4170 on north portion of the Tonto NF (USFS 1986c); PIED/BOGR occurs generally in HSC climate.

COMMENT: Important h.t. for livestock. Year long or cool season grazing has often reduced or eliminated cool season grasses while favoring shrubs and short statured warm season grasses. On some sites Juniperus or tall shrubs serve as nurse sites for regeneration of Arizona pinyon.

H. T. Arizona pinyon/Blue grama

REGENERATION

CLEARCUT	favors nonwoody vegetation
SHELTERWOOD	favors pinyon
SEED TREE	favors nonwoody vegetation
SELECTION	favors pinyon

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	juniper and oaks (when present)
BURNING	nonwoody vegetation
NONE	pinyon

REVEGETATION slow to moderate, rapid when oak is present

PRODUCTIVITY

SITE INDEX $\frac{30}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL high LATE SERAL moderate

OTHER Fair potential for cover in late seral stages. Relatively broad range of potential for fuelwood production.

Pinus fallax/Canotia holacantha

Arizona pinyon/Crucifixion thorn 233030
PIFA/CAHO

SITE: 3500-4000 ft on n-slopes of dissected, erosional escarpments and hills; MAP = 20 in/yr, MAT = 59-61 F.

TES: 4,0 LSM

TREES: Well represented. Pinus fallax, Juniperus osteosperma, Juniperus erythrocarpa.

SHRUBS: Well represented. Canotia holacantha*, Quercus turbinella, Yucca baccata, Y. elata, Dasylirion wheeleri, Berberis haematocarpa, Dalea formosa, Mimosa biuncifera, Arctostaphylos pungens, Rhamnus crocaea, Cowania stansburiana v. mexicana, Gutierrezia sarothrae.

HERBS: Common or well represented. Bouteloua curtipendula, B. hirsuta, Bouteloua eriopoda, Tridens elongatus, Aristida spp., Stipa neomexicana, Poa fendleriana, Sitanion hystrix, Melampodium leucanthum.

DIS: c-AZ south of the Mogollon Rim.

ALSO SEE: The Terrestrial Ecosystem Survey (USFS 1986c) reports a PIMO/JUOS/QUTU2/ARPU5/CAHO3 subseries in northern portions of the Tonto NF (eg mapping unit 3770, loamy-skeletal, calcareous Typic Ustochrepts).

NOTE: Adjoining elevated plains in the Prescott NF contain mesquite grasslands.

H. T. Arizona pinyon/Crucifixion thorn

REGENERATION

CLEARCUT	N/A
SHELTERWOOD	N/A
SEED TREE	N/A
SELECTION	N/A

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	N/A
BURNING	N/A
NONE	woody shrubs, Arizona pinyon

REVEGETATION slow

PRODUCTIVITY

SITE INDEX $\frac{25}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER High erosion potential must be considered in any activity.

Pinus fallax/Quercus turbinella

Arizona pinyon/shrub live oak 233040
PIFA/QUTU

SYN:

SITE: Lowest elevational limits of Pinus fallax on wide variety of soils and landforms.

TES: 4,0 LSM

TREES: Abundant. Pinus fallax, Juniperus osteosperma, J. monosperma, and sometimes Quercus emoryi will be occasional.

SHRUBS: well represented to abundant. Quercus turbinella, Rhus trilobata, Mimosa biuncifera, Cercocarpus montanus, Berberis haematocarpa, Yucca baccata, Nolina microcarpa, Atriplex canescens, Opuntia phaeacantha, O. spinosior, and on calcareous soils, Cowania mexicana and Ceanothus greggii, Menodora scabra, Eriogonum wrightii, Gutuerrezia sarothrae.

HERBS: Well represented. Bouteloua gracilis, B. curtipendula, B. hirsuta, Aristida longiseta, Aristida spp., Sporobolus cryptandrus, Lycurus phleoides, Bothriochloa barbinodis, Schizachyrium scoparium, Hilaria belangeri, Koeleria macrantha, Poa fendleriana, Sitanion hystrix, Stipa spp., numerous forbs.

DIS: c-AZ mostly s of the Mogollon Rim tapering to occasional stands near the NM border.

ALSO SEE: Common occurrence of Pinus fallax separates PIFA/QUTU from JUER/QUTU. Arctostaphylos pungens may be accidental in PIFA/QUTU but becomes common or well represented in PIFA/ARPU.

COMMENT: The tree understory can appear as a patchy mosaic of shrubs amid corridors of grasses and half shrubs. Relationships between Quercus turbinella, grasses, and conifer densities appear to be rapidly changing at present. Frequent fire may favor oak dominance and slow succession to coniferous woodland.

H. T. Arizona pinyon/Shrub live oak

REGENERATION

CLEARCUT	favors oak and shrubs
SHELTERWOOD	favors pinyon
SEED TREE	favors oak and shrubs
SELECTION	favors pinyon

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	pinyon
BURNING	oak and shrubs
NONE	pinyon

REVEGETATION rapid because of oak sprouting

PRODUCTIVITY

SITE INDEX $\frac{20}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none
Reduce ratings is turbunella oak is abundant.

OTHER A good browse producer and good cover for deer.
Fires produce a chaparral vegetation.

Pinus fallax/Yucca baccata

Arizona pinyon/Banana yucca
PIFA/YUBA

233050

SITE: Steep s or w slopes around 6000 ft.

TES: 4 0 LSM

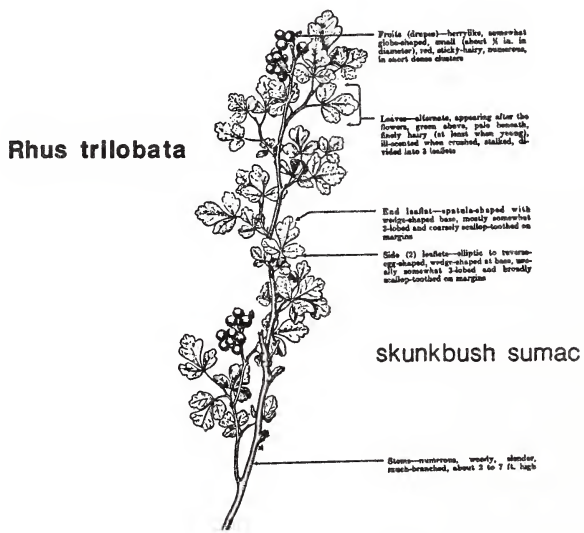
TREES: Luxuriant. Pinus fallax (C), Juniperus osteosperma (S), Juniperus cf monosperma (s), occasional Quercus x grisea. NOTE: At Fort Apache Pinus fallax and Pinus edulis may hybridize at sites within this association.

SHRUBS: Common. Shrubby Quercus x grisea, Quercus x turbinella, Yucca baccata, Rhus trilobata, Cercocarpus montanus, Gutierrezia sarothrae.

HERBS: Scarce. Eriogonum sp., annuals.

DIS: Presently known from Fort Apache Res., AZ

ALSO SEE: Pinus edulis/sparse community type (USFS 1986a) is perhaps indistinguishable.



H. T. Arizona pinyon/Banana yucca

REGENERATION

CLEARCUT	favors shrubs
SHELTERWOOD	favors pinyon
SEED TREE	favors juniper and shrubs
SELECTION	favors pinyon

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	shrubs
BURNING	shrubs
NONE	Arizona pinyon

REVEGETATION slow

PRODUCTIVITY

SITE INDEX $\frac{25}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER Moderate potential for fuelwood production. Little to no potential for livestock grazing. Good wildlife hiding cover potential. High erosion potential on steep slope when vegetation is removed.

Pinus edulis/Cercocarpus montanus

Pinyon pine/Mountain mahogany
PIED/CEMO

Quercus grisea phase 204032
Quercus gambelii phase 204033

SITE: Mostly steep and moderately steep slopes from 6,700-7,500 ft.; often Udic and Lithic Ustochrepts; MAP about 18 in/yr, mean annual air temperature about 53 F.

TES: 4, 0,+1.

TREES: Well represented. Pinus edulis, Juniperus monosperma (lower elevation sites), Juniperus osteosperma, Juniperus deppeana.

SHRUBS: Often abundant. Cercocarpus montanus, Rhus trilobata, Amelanchier spp., Berberis haematocarpa, Quercus grisea, Q. gambelii, Fendlera rupicola, Yucca baccata, Gutierrezia sarothrae.

HERBS: Common or well represented, but much less important than shrubs. Bouteloua curtipendula, B. gracilis, B. hirsuta, Andropogon scoparium, Muhlenbergia pauciflora, Lycurus phleoides.

DIS: se-AZ, NM, s-CO.

ALSO SEE: Scarp woodland. Cercocarpus montanus occurs in numerous woodlands, but PIED/CEMO features a chaparralic expression of the shrubs (i.e. dense shrubs) and relatively minor herbs.

COMMENTS: Excellent habitat for wildlife browse and winter range.

H. T. Pinyon pine/Mountain mahogany

REGENERATION

CLEARCUT	is not recommended
SHELTERWOOD	is usually successful
SEED TREE	is not usually successful
SELECTION	is often the best method

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	shrub species; oak when the oak phase
BURNING	shrub species; oak when the oak phase
NONE	pinyon

REVEGETATION moderately rapid due to resprouting of shrubs

PRODUCTIVITY

SITE INDEX $\frac{25}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER Good potential for palatable deer browse. Fair to excellent potential for cover. Wavyleaf oak phase is excellent winter habitat for deer.

Pinus edulis/Chrysothamnus nauseosus-Fallugua paradoxa

26W

Pinyon pine/Rabbitbrush-Apache plume; PIED/CHNA-FAPA 204330

SITE: Intermittent washes and river terraces, 6,300-7,500 ft.; common soils include Typic Ustifluvents, Fluventic Haplustolls, and Fluventic Ustochrepts. These are often incised with arroyos or gullies. Site specific determination of soils may be needed.

TES: 4, 0 and 4, +1.

TREES: Common or well represented. Pinus edulis, Pinus fallax, or Pinus discolor (depending upon geography), Juniperus spp., infrequent Populus angustifolia in some areas.

SHRUBS: Abundant. Chrysothamnus nauseosus var. graveolens, Fallugia paradoxa, Atriplex canescens, Brickellia californica, Rhus trilobata, Gutierrezia sarothrae, Berberis haematocarpa.

HERBS: Well represented. Bouteloua gracilis, B. curtipendula, Agropyron smithii, and numerous other grasses and forbs.

DIS: Widespread in NM and AZ but very local in the landscape.

ALSO SEE: Mapping unit 71 in TES for Carson National Forest (USFS 1986b), and MU 58 in TES for the Apache-Sitgreaves NFs (USFS 1987b). If cottonwoods are common, see riparian forests.

COMMENTS: Periodic flooding, arroyo cutting, and sustained livestock grazing can weaken the tree and perennial grass components and increase the importance of shrubs and annuals.

H. T. Pinyon pine/Rabbitbrush-Apache plume

REGENERATION

CLEARCUT	favors shrubs
SHELTERWOOD	favors pinyon pine
SEED TREE	favors shrubs
SELECTION	favors pinyon pine

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	Rabbitbrush and Apache plume
BURNING	Rabbitbrush and Apache plume
NONE	Pinyon pine

REVEGETATION moderately rapid due to resprouting of shrubs and grasses.

PRODUCTIVITY

SITE INDEX $\frac{25}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL high LATE SERAL low

OTHER Good potential for palatable deer browse if Apache plume is present.

Pinus edulis/Sparse community type

Pinyon pine/Sparse
PIED/SPARSE

204500

SITE: Often between 6500-7300 ft. on basaltic mesas or hill slopes; soils are highly variable, and on-site determination may be required (see comments).

TES: 4, 0.

TREES: Abundant. Pinus edulis, P. fallax, P. discolor (depending upon geography), Juniperus osteosperma, J. deppeana, J. erythrocarpa, J. monosperma.

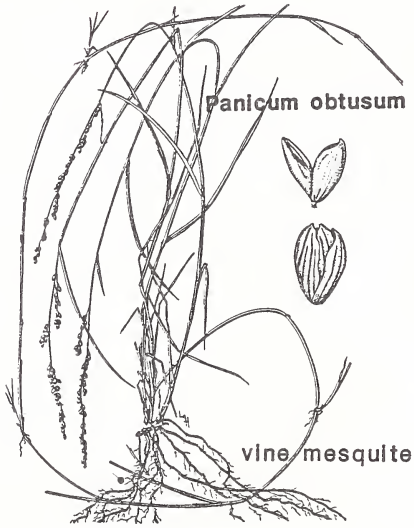
SHRUBS: Scarce or common. Rhus trilobata, Opuntia spp.

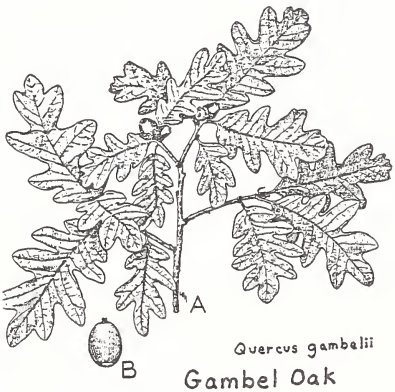
HERBS: Perennial herbs are scarce, annuals may be common to well represented or even abundant.

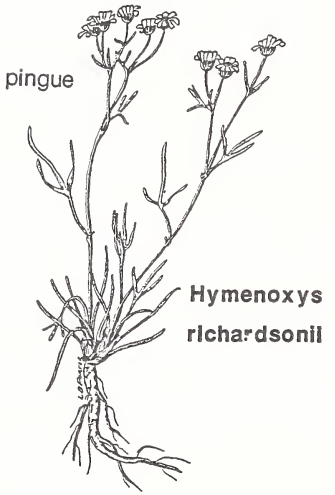
DIS: Widespread geographically but often local in the landscape.

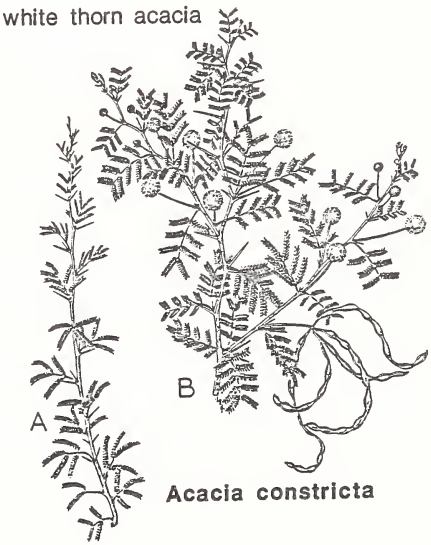
ALSO SEE: USFS (1987a), PIED/ROCKLAND (USFS 1987a).

COMMENTS: This community type is derived from woodlands with a history of livestock grazing, soil erosion, and fire cessation. It may be an advanced successional stage from several habitat types, as well as a prolonged successional stage (disclimax) under current soil and management conditions. Erosional "badlands" represent PIED/SPARSE as a natural plant association.


Panicum obtusum
vine mesquite


A
B
Quercus gambelii
Gambel Oak


pingue
Hymenoxys
richardsonii


white thorn acacia
A
B
Acacia constricta

Juniperus deppeana/Arctostaphylos pungens

Alligator juniper/Manzanita 231010
JUDE/ARPU

SYN:

SITE: 5300 ft on a variety of slopes, Typic Haplustalfs.

TES: 4,0 LSM

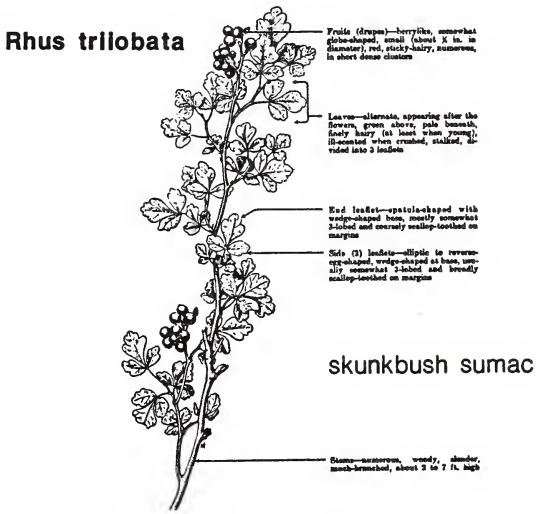
TREES: Well represented. Juniperus deppeana dominates, Quercus emoryi and Juniperus erythrocarpa are both common.

SHRUBS: Abundant. Arctostaphylos pungens, A. pringlei, Quercus turbinella, Cercocarpus montanus, Rhus trilobata, Mimosa biuncifera, Ceanothus greggii, Rhus ovata, Garrya wrightii, Gutierrezia sarothrae.

HERBS: Scarce. Bouteloua curtipendula, B. hirsuta, Aristida spp.

DIS: presently known from one location at foot of Bradshaw Mts, AZ (T11 1/2N, R1W, S24)

ALSO SEE: PIFA/ARPU. The absence of Pinus fallax distinguishes JUDE/ARPU.



H. T. Alligator juniper/Manzanita

REGENERATION

CLEARCUT	favors alligator juniper, manzanita, and oak
SHELTERWOOD	favors alligator juniper
SEED TREE	favors alligator juniper, manzanita, and oak
SELECTION	favors alligator juniper

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL *	alligator juniper and manzanita
BURNING	alligator juniper and manzanita
NONE	alligator juniper and manzanita

REVEGETATION rapid because of the sprouting characteristics

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER Livestock grazing potential is very low.

* Consult TES reports for soil limitations due to texture and slope.

Juniperus deppeana/Bouteloua gracilis

30W

Alligator juniper/Blue grama — 231020
JUDE/BOGR — Prosopis phase 231021

SYN:

SITE: 5200 ft on n aspects to 6600 ft on s aspects; MAP 19 in/yr; MAAT 55 F; often heavy clay soils (see TES reports)

TES: 4,0 and 4,-1 (Prosopis phase) HSM

TREES: Well represented. Juniperus deppeana (often 5-10% cover), Pinus edulis (usually scarce but sometimes common), and scarce amounts of Juniperus monosperma, Quercus emoryi, and Q. grisea (these oaks may appear as low trees or shrubs), Juniperus osteosperma (sometimes common, e.g. Globe RD)

SHRUBS: Scarce or common. Eriogonum wrightii, Gutierrezia sarothrae, Nolina microcarpa, Dasylirion wheeleri, Yucca baccata, Ceanothus greggii, Opuntia phaeacantha, O. chlorotica, O. spinosior, Calliandra eriophylla, Prosopis glandulosa (common in Prosopis phase).

HERBS: Abundant, especially grasses. Bouteloua curtipendula, B. gracilis, B. hirsuta, Hilaria belangeri, Muhlenbergia emersleyi, Panicum obtusum Eragrostis intermedia, Aristida divaricata, Stipa comata, Calliandra humilis, Artemisia carruthii.

DIS: s-NM and AZ south of the Mogollon Rim.

ALSO SEE: TES report for Apache-Sitgreaves NF (USFS 1987b) has mapping units 587 and 589 within a JUDE2-NOMI subseries (mostly in the Clifton RD); MUs 512 and 582 within this subseries have very steep slopes and appear to intergrade to scarp woodland. For Globe RD see MU 4140 of JUDE2-BOGR2-PAOB subseries (USFS 1984). For Glenwood RD see MU 3914 and local sites of JUDE/BOGR in MU 3828 (USFS 1985).

H. T. Alligator juniper/Blue grama

REGENERATION

CLEARCUT	favors alligator juniper, oak (if present) and grass
SHELTERWOOD	favors alligator juniper
SEED TREE	favors grass
SELECTION	favors alligator juniper

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL *	alligator juniper and oak (if present)
BURNING	alligator juniper and oak (if present)
NONE	alligator juniper

REVEGETATION relatively rapid due to sprouting of alligator juniper and oak (if present)

PRODUCTIVITY

SITE INDEX $\frac{25}{\text{PIED}}$ +

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL low

OTHER Range potential lost relatively rapid due to resprouting of alligator juniper.

* See TES reports for limitations on heavy clay soils and for other textural limitations.

Juniperus osteosperma/Bouteloua gracilis

Utah juniper/Blue grama
JUOS/BOGR

Typic phase 202320
Cowania stansburiana phase 202321

SYN: Juniperus monosperma/Bouteloua gracilis, Juniperus osteosperma phase (USFS 1986a).

SITE: 5000-6000 ft, valley and elevated plains and piedmont alluvial fans, MAP =

TES: 4, -1 LSC

TREES: Well represented. Juniperus osteosperma, Pinus edulis (a)

SHRUBS: Scarce (typic phase) or well represented (COST phase). Yucca glauca, Cowania stansburiana, Berberis haematocarpa, Lycium pallidum.

HERBS: Well represented to abundant especially grasses. Bouteloua gracilis, Bouteloua eriopoda, B. curtipendula, Aristida longiseta, Aristida spp, Lycurus phleoides, Muhlenbergia torreyi, Sitanion hystrix, Stipa neomexicana, Koeleria macrantha, Agropyron smithii, Eriogonum wrightii.

DIS: c- to n-AZ

ALSO SEE: JUMO/BOGR is generally centered in HSC climates.

NOTE: The cool season grass component of this association is often absent or weakly expressed as result of year-long or winter livestock grazing over many years. Well represented populations of Gutierrezia sarothra often indicate such grazing history.

H. T. Utah juniper/Blue grama

REGENERATION

CLEARCUT	favors site conversion to grass
SHELTERWOOD	favors juniper
SEED TREE	favors grass
SELECTION	favors juniper

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	juniper
BURNING	grass
NONE	juniper

REVEGETATION slow

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL LOW

OTHER

Juniperus osteosperma-J. monosperma/ Sparse community type

32W

Juniper/Sparse c.t. (h.t.)
JUOS-JUMO/SPARSE c.t. (h.t.)

202500

SITE: 5,000-6,400 ft. often adjoining grasslands of valley plains or piedmont slopes; MAP = 14-16 in/yr. but as low as 12 in/yr. wide variety of soils and parent materials. See comments.

TES: 4, -1.

TREES: Well represented to abundant. Juniperus osteosperma and J. monosperma.

SHRUBS: Scarce.

HERBS: Perennials are scarce, annuals may be well represented.

DIS: Widespread in NM and AZ.

ALSO SEE: USFS (1986ab)

COMMENTS: Often Juniper/Sparse is a degraded stage of other habitat types. Where soil erosion is naturally intense, Juniper/Sparse may be a "badland" plant association, as well as on special parent materials such as gypsum. Soil and landform features are critical in helping distinguish seral or climax (potential) expressions of Juniper/Sparse.

Juniperus osteosperma/Hilaria mutica

Utah juniper/Tobosa
JUOS/HIMU

Prosopis phase 202330
Pinus fallax phase 202331

SYN:

SITE: Elevated or valley plains, 4300-5900 ft, heavy clay soils, MAP 17-18 in/yr (to 20 in/yr for PIFA phase), MAAT 55-61 F.

TES: 4,-1 LSM/HSM; 4,0 LSM (Pinus fallax phase)

TREES: Well represented (5-10% cover). Juniperus osteosperma, Juniperus erythrocarpa, Pinus fallax (PIFA phase)

SHRUBS: Common or well represented (especially on heavily grazed sites). Prosopis sp. (varieties of mesquite depend upon geography), Mimosa biuncifera, Gutierrezia sarothrae, Nolina microcarpa, Acacia greggii, Opuntia phaeacantha, O. spinosior, O. whipplei, Krameria parvifolia.

HERBS: Abundant to luxuriant. Hilaria mutica*, Hilaria belangeri*, Panicum obtusum*, Bouteloua curtipendula, Bouteloua gracilis, B. hirsuta, Aristida spp., and numerous annuals including Helianthus annuus, Bromus rubens, Leptochloa filiformis, Panuicum capillare, Haplopappus gracilis.

DIS: widespread south of the Mogollon Rim.

ALSO SEE:. Mapping units (MUs) 469 and 479 on Clifton RD (USFS 1987b); MUs 3181 3187, and 3700 (PIFA phase) on Globe RD (USFS 1984); MU 3832 on the Glenwood RD (USFS 1985). The various subseries of these TES mapping units include JUMO-PRGLT-HIBE-HEAN, JUOS-JUMO-PRVE-BOHI-HIBE, JUOS-HIBE-PAOB, and JUMO-JUOS-PRGLG.

COMMENT Historical photos suggest that valleys and mesa tops were once steppic and free of junipers or strong shrub cover. Since about 1880 a combination of livestock grazing, fire suppression, and soil erosion are among the factors producing shrub and juniper increases. Herbs most tolerant of heavy grazing include Hilaria belangeri, H. mutica, and annuals.

H. T. Utah juniper/Tobosa

REGENERATION

CLEARCUT	favors grass and shrubs
SHELTERWOOD	favors juniper
SEED TREE	favors grass and shrubs
SELECTION	favors juniper

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL *	shrubs
BURNING	shrubs
NONE	juniper and pinyon (if present)

REVEGETATION slow to moderate

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER Soils tend to be subject to severe erosion if grazing levels are too high. Low fuelwood potential.

* See TES reports for mechanical limitations due to soil texture.

Juniperus monosperma/Bouteloua curtipendula

One-seed juniper/Sideoats grama — Nolina microcarpa phase 201011
JUMO/BOCU

SITE: 4900-5600 ft., often on steep colluvial slopes; MAP 15-19 in/yr, MAAT 55-57 F; soils stony or rocky, often interrupted by rock outcrop, wide variety of parent materials.

TES: 4,-1 HSM

TREES: Well represented. Juniperus monosperma (C), Quercus grisea (c), Pinus edulis (accidental or occasional).

SHRUBS: Well represented. Rhus trilobata, Nolina microcarpa, Ceanothus greggii, Dasylirion wheeleri, Yucca baccata, Opuntia phaeacantha, Opuntia spinosior, Gutierrezia sarothrae, Eriogonum wrightii, and shrubby forms of Qurecus grisea (and intergrades to Q. turbinella).

HERBS: Well represented to abundant. Bouteloua gracilis, B. curtipendula, B. hirsuta, B. eriopoda, Muhlenbergia emersleyi, Bothriochloa barbinodis, Schizachyrium cirratum, Aristida orcuttiana, Koeleria macrantha, Poa fendleriana, Stipa spp., Eragrostis intermedia, Sitanion hystrix, Leptochloa dubia, Lycuris phleoides, Bouteloua radicosa, numerous forbs.

DIS: Clifton RD (Apache NF), s-NM into s-CO.

ALSO SEE: Scarp woodland on steep, rocky slopes; TES mapping units 224, 412, 432 for Apache-Sitgreaves NFs (USFS 1987b); for other phases see USFS (1987a).

COMMENTS:

H. T. One-seed juniper/Sideoats grama

REGENERATION

CLEARCUT	favors site conversion to grass
SHELTERWOOD	favors juniper
SEED TREE	favors grass
SELECTION	favors juniper

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	juniper
BURNING	conversion to grass
NONE	heavy grazing favors juniper

REVEGETATION slow

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER

Juniperus erythrocarpa/Canotia holacantha

35W

Red berry juniper/Crucifixion thorn
JUER/CAHO

230030

SYN:

SITE: Dissected elevated plains, eroding breaks of valley fill alluvia, and steep, erosional hills; calcareous parent materials; MAP 16-20 in/yr, MAAT 59-63 F; thermic soil temperature regime.

TES: 4,-1 LSM.

TREES: Well represented (5-10% cover). Juniperus erythrocarpa, Juniperus osteosperma.

SHRUBS: Well represented. Canotia holacantha*, Quercus turbinella, Nolina microcarpa, Berberis haematocarpa, B. fremontii, Opuntia spp., Dasylirion wheeleri, Prosopis velutina, Gutierrezia sarothrae, Eriogonum wrightii, Yucca elata, Y. baccata.

HERBS: Scarce or common. Bouteloua curtipendula, B. hirsuta, B., eriopoda, Aristida longiseta, Aristida spp., Sporobolus cryptandrus, Stipa neomexicana, Bothriochloa barbinodis, Schizachyrium scoparium, Hilaria belangeri, Koeleria macrantha, Poa fendleriana, Sitanion hystrix, Muhlenbergia porteri, Tridens mutica, scattered forbs.

DIS: c-AZ south of the Mogollon Rim (Prescott and Tonto NFs, Ft Apache, San Carlos Res).

ALSO SEE: TES mapping units 3350-52, 3359-60 in northern portion of the Tonto NF (USFS 1986c); JUER/QUTU.

NOTE: For separating Juniperus erythrocarpa and J. monosperma see Fletcher (1985).

H. T. Red berry juniper/Crucifixion thorn

REGENERATION because of soil erosion and low productivity

CLEARCUT	N/A
SHELTERWOOD	N/A
SEED TREE	N/A
SELECTION	N/A

PLANTING is not recommended

SITE PREPARATION because of soil erosion

METHOD	FAVORS:
MECHANICAL	N/A
BURNING	N/A
NONE	N/A

REVEGETATION very slow

PRODUCTIVITY

SITE INDEX low

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER See TES reports for extreme soil limitations.

Juniperus erythrocarpa/Quercus turbinella

36W

Red berry juniper/Shrub live oak
JUER/QUTU

Quercus turbinella phase 230040
Prosopis phase 230041
Bouteloua gracilis phase 230042

SYN:

SITE: Complex hillslopes, dissected pediments and toeslopes, elevated plains and alluvial fans, and eroding breaks of old valley fill alluvium; often moderately steep and steep slopes, 3600-4800 ft; MAP 16-20 in/yr, MAAT 59-63 F, thermic soil temperature regime.

TES: 4,-1 LSM

TREES: Well represented (5-15% canopy cover). Juniperus erythrocarpa sometimes mixed with Juniperus osteosperma; occasional Cercidium microphyllum (Globe RD).

SHRUBS: Well represented or abundant. Quercus turbinella*, Prosopis velutina, Berberis haematocarpa, B. fremontii, Acacia greggii, Calliandra eriophylla, Ceanothus greggii, Condalia spathulata, Rhus trilobata, Mimosa buiuncifera, Nolina mcrocarpa, Gutierrezia sarothrae, Eriogonum wrightii, Krameria parvifolia, Opuntia phaeacantha.

HERBS: Common to abundant depending on shrub cover. Bouteloua gracilis, B. hirsuta, B.eriopoda, B curtipendula, Aristida spp., Sporobolus cryptandrus, Hilaria belangeri (heavy clay soils), Muhlenbergia torreyi, Bothriochloa barbinodis, Schizachyrium scoparium, Muhlenbergia porteri, Koeleria macrantha, Poa fendleriana, Sitanion hystrix, Stipa spp., Tridens muticus, Sphaeralcea spp., Bromus rubens, Haplopappus spinulosus, Erodium cicutarium, and other annuals.

DIS: c-AZ south of the Mogollon Rim (Prescott and Tonto NFs, Ft Apache, San Carlos Res.) to se AZ.

ALSO SEE: TES mapping units (MUs) 2055, 3053, 3181, 3313, 3809 on Globe RD (USFS 1984); MUs 3050, 3060, 3231, 3236, 3261, 3333, 3339, 3371, 3469, 3521, 3760, 3761 for northern portions of the Tonto NF (USFS 1986c); JUER/CAHO also has Quercus turbinella and is usually found on eroding breaks with calcarous soils. In sw NM (HSM climate) see the Prosopis glandulosa phase of JUMO/BOGR occurring, for example, on TES MUs 3828, 3829, 3945, 3947, 3971 in the Glenwood RD (USFS 1985). On heavy clay soils (elevated and valley plains) see JUOS/HIMU.

NOTES: For separating Juniperus erythrocarpa and J. monosperma see Fletcher (1985). For separating phases, see key. Photographic records indicate that shrub live oak and mesquite have increased in geographic extent and in coverage since about 1900.

H. T. Red berry juniper/Shrub live oak

REGENERATION

CLEARCUT	favors oak and shrub species
SHELTERWOOD	favors juniper
SEED TREE	favors oak and shrub species
SELECTION	favors juniper

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	juniper
BURNING	oak and shrubs
NONE	juniper

REVEGETATION rapid due to sprouting of oak

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL low
Reduce ratings if turbinella oak is abundant.

OTHER Can be subject to high erosion if overgrazed. Can be a fire hazard. Fires produce a chapparal vegetation.

Cupressus arizonica/Quercus hypoleucoides

Arizona cypress/silverleaf oak 031010
CUAR/QUHY

SYN:

SITE: 4800-5800 ft (depending on aspect), slopes and drainages on a wide variety of landforms, parent materials, and soils; often cool, n or e slopes, or soils with high subsurface water tables or lateral flow.

TES: 4,+1 HSM.

TREES: Luxuriant. Cupressus arizonica*, Pinus discolor, Quercus hypoleucoides, Quercus chrysolepis var palmeri, Quercus arizonica.

SHRUBS: Well represented. Quercus rugosa, Arctostaphylos pungens, Cercocarpus montanus, Fendlera rupicola, Garrya wrightii, Ceanothus fendleri, Nolina microcarpa, Fraxinus anomalous, Prunus virginiana.

HERBS: Common. Bouteloua curtipendula, Poa fendleriana, Carex geophila, Koeleria macrantha, Stipa pringlei, Stipa spp., Sitanion hystrix, Schizachyrium scoparium, Muhlenbergia longiligula, M. richardsonii,ria Senecio neomexicanus.

DIS: Woods Canyon (Clifton RD), Dragoon, Santa Catalina, and Chiricahua Mts, se AZ

ALSO SEE: TES mapping units 714 and 720 for Apache NF (USFS 1987b); Parker (1980ab), Moir and Lukens (1976). Wetter habitats containing Cupressus arizonica are riparian forests. CUAR/QUTU is a drier h.t. lacking silverleaf oak.

H. T. Arizona cypress/Silverleaf oak

REGENERATION

CLEARCUT	favors oak
SHELTERWOOD	favors Arizona cypress
SEED TREE	favors oak
SELECTION	favors Arizona cypress

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL	oak
BURNING *	oak
NONE	Arizona cypress

REVEGETATION rapid from oak sprouting

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL moderate LATE SERAL low

OTHER Excellent for deer, bear, and non-game animals.
* Fires may be important for seed germination of Arizona cypress. Role of fire needs more study.

Cupressus arizonica/Quercus turbinella

Arizona cypress/Shrub live oak 031020
CUAR/QUTU

SYN:

SITE: mostly north aspects between 4800-5800 ft; MAP 18-22 in/yr

TES: 4,-1 LSM.

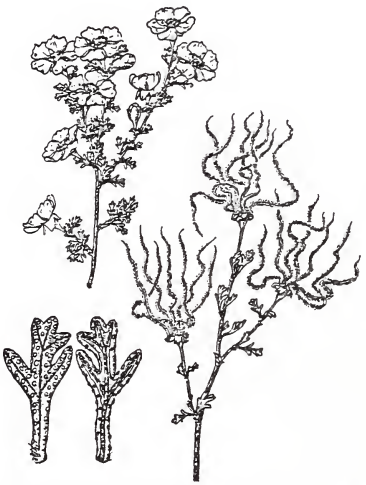
TREES: Luxuriant. Cupressus arizonica var glabra, Pinus fallax, Juniperus osteosperma.

SHRUBS: Abundant. Quercus turbinella, Arctstaphylos pungens, A. pringlei, Quercus chrysolepis var palmeri, Garrya wrightii, Rhus ovata, Cercocarpus montanus, Ceanothus greggii, Cowania stansburiana var mexicana, Fraxinus anomala, Nolina microcarpa, Rhamnus crocaea.

HERBS: Typically scarce because of strong tree and shrub dominance.

DIS: Tonto NF north to vicinity of Sedona in Oak Creek Canyon; local elsewhere in s and se AZ; Cooke Range NM.

ALSO SEE: Arizona cypress-shrub live oak association (Carmichael et al 1978), CUGL-PIMO-QUTU2-ARPU5 subseries (mapping units 4468, 4469) on Tonto NF (USFS 1986c); Parker 1980b.



Cowania stansburiana var mexicana

H. T. Arizona cypress/Shrub live oak

REGENERATION

CLEARCUT	favors oak
SHELTERWOOD	favors Arizona cypress
SEED TREE	favors oak
SELECTION	favors Arizona cypress

PLANTING is not recommended

SITE PREPARATION

METHOD	FAVORS:
MECHANICAL *	oak
BURNING	oak and cypress
NONE	Arizona cypress

REVEGETATION rapid from oak sprouting

PRODUCTIVITY

SITE INDEX _____

FORAGE VALUE RATING (CATTLE): EARLY SERAL low LATE SERAL none

OTHER * See TES reports for limitation on soil due to texture and slope steepness.

BOTANY

Prosopis velutina – mesquite

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Plant Association Symbols and Names

(Alphabetical by botanical name)

Arizona south of Mogollon Rim and southwestern New Mexico

Symbol	Botanical Name	Common Name
ABCO	Abies concolor	white fir
ABLA	Abies lasiocarpa	corkbark fir
ACGL	Acer glabrum	Rocky Mountain maple
ACGR	Acer grandidentatum	big toothed maple
ALTE	Alnus tenuifolia	thinleaf alder
ANCI	Andropogon cirratus (Schizachyrium cirratum)	Texas bluestem
ARPU	Arctostaphylos pungens	manzanita
BERE	Berberis repens	Oregon grape
BOCU	Bouteloua curtipendula	sideoats grama
BOGR	Bouteloua gracilis	Blue grama
BRCI	Bromus ciliatus	fringed brome
CAFO	Carex foenea	fony sedge
CAHO	Canotia holacantha	crucifixion thron
CEMO	Cercocarpus montanus (also C. breviflorus)	mountain mahogany
CHAR	Choisya arizonica	star-leaf
CHNA	Chrysothamus nauseous	rabbitbrush
COST	Cowania stansburiana var mexicana	cliffrose
CUAR	Cupressus arizonica	Arizona cypress
DAWH	Dasylirion wheeleri	sotol
EREX	Erigeron eximius	forest fleabane
FAPA	Fallugia paradoxa	Apache plume
FEAR	Festuca arizonica	Arizona fescue
HIMU	Hilaria mutica	tobosa
JAAM	Jamesia americana	waxflower
JUMA	Juglans major	walnut
JUDE	Juniperus deppeana	alligator juniper
JUER	Juniperus erythrocarpa	red berry juniper
JUMO	Juniperus monosperma	one seed juniper
JUOS	Juniperus osteosperma	Utah juniper
MUEM	Muhlenbergia emersleyi	bullgrass
MULO	Muhlenbergia longiligula	longtongue muhly
MUMO	Muhlenbergia montana	mountain muhly
MUVI	Muhlenbergia virescens	screwleaf muhly
NOMI	Nolina microcarpa	beargrass
PIEN	Picea englemannii	Englemann spruce
PIPU	Picea pungens	blue spruce
PIDI	Pinus discolor	border pinyon
PIED	Pinus edulis	pinyon pine
PINEN	Pinus engelmannii	Apache pine
PIFA	Pinus fallax	Arizona pinyon
PILE	Pinus leiophylla	Chihuahua pine
PIST	Pinus strobiformis	Southwestern white pine

PIPO	Pinus ponderosa	ponderosa pine
PIFI	Piptochaetium fimbriatum	pinyon ricegrass
PLWR	Platanus wrightii	sycamore
POAN	Populus angustifolia	narrow-leaf cottonwood
POFR	Populus fremontii	broadleafed cottonwood
POFE	Poa fendleriana	muttongrass
POPR	Poa pratensis	Kentucky bluegrass
PRVE	Prosopis velutina	mesquite
PSME	Pseudotsuga menziesii var glabrum	Douglas-fir
QUAR	Quercus arizonica	Arizona white oak
QUEM	Quercus emoryi	Emory oak
QUGA	Quercus gambelii	Gambel oak
QUGR	Quercus grisea	Gray oak
QUHY	Quercus hypoleucoides	silverleaf oak
QURU	Quercus rugosa	netleaf oakk
QUTO	Quercus toumeyi	Toumey oak
QUTU	Quercus turbinella	shrub live oak
QUUN	Quercus undulata	wavyleaf oak
RHCO	Rhus coriophylla	leatherleaf sumac
RHTR	Rhus trilobata (R. aromatica)	skunkbush sumac
RONE	Robinia neomexicana	New Mexico locust
RUPA	Rubus parviflorus	thimbleberry
SABE	Salix bebbiana	Bebb willow
SASC	Salix scouleriana	Forest willow
VAMY	Vaccinium myrtillus	myrtleleaf huckleberry
YUBA	Yucca baccata	bannana yucca

Chrysopsis villosa

(Heterotheca v.)

flowers yellow

hairy golden aster

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GPO 855-027

Synoptic Table of Major Vascular Plant Families

(The 38 listed families comprise about 85% of species diversity in the SW)

Dicots

Family	Common Name	Form	K	C	A	G	Fruit Type	Miscellaneous Comments
Salicaceae	willow	TS	0-x	0	2-x	(2)	cap	seeds comose, plants dioecious, flws in catkins
Polygonaceae	knotweed	HS	5 or 3+3	0	3-9	(3)	ach	calyx often petaloid, ach often triangular, lvs alternate, simple
Chenopodiaceae	goosefoot	HS	5	0	5	(2)	nutl	lvs alternate, simple, exstipulate, perianth green inconspicuous
Amaranthaceae	pigweed	HS	4-5	0	4-5	(2-3)	utr, pyx	flws subtended by papery bracts, similar to goosefoot
Nyctaginaceae	four o'clock	HST	5	0	5	1	ach	bracts mimic sepals, sepals mimic petals, lvs simple, opposite stems tend to branch dicotomously
Portulacaceae	purslane	H	2	4-6	4-∞	2-8	cap	lvs often fleshy, cap dehisces longitudinal or circumscissle
Caryophyllaceae	pink	H	5 or (5)	5[0]	5-10	2-5	cap, utr	cap many seeded, lvs opposite, linear or lanceolate, stem nodes swollen
Ranunculaceae	buttercup	HS[V]	3-x	0-∞	∞	∞	fol, ach, ber	lvs often palmately dissected, exstipulate with a sheathing base
Cruciferae (Brassicaceae)	mustard	HS	4	4	4+2	(2)	sil, slq	petals cruciform, often clawed, often with acrid taste
Primulaceae	primrose	H	5	(5)	5	(5)	cap, pyx	plants mostly scapose, lvs simple, basal, opposite, stamens opposite petals
Saxifragaceae	saxifrage	HS	5[4]	5[4]	5 or 10	2	cap	hypanthium present, lvs alternate or basal, exstipulate
Rosaceae	rose	HST	5	5[0]	∞	∞(5)1	ach, drp, pom, fol	hypanthium present, lvs alternate, usually stipulate
Leguminosae (Fabaceae)	pea	HSTV	5	5 or 5z	5-∞	1	leg	lvs alternate, mostly compound, stamens usually 10
Euphorbiaceae	spurge	HST	0 or 5	0 or 5	1-∞	(3)	schizo	often with milky latex, fruit 3 nutlets, flws unisexual usually much reduced
Malvaceae	mallow	HST	3-5	5	∞	(5-∞)	cap, schizo	often with stellate pub, lvs alternate, palmately veined and/or lobed
Loasaceae	loasa	H	5	5	5-∞	(3-7)	cap	flws showy yellow to white, often with stinging or at least rough, bristly glochidiate hairs
Cactaceae	cactus	HS	x	∞	∞	(2-∞)	ber	usually spiny succulents
Onagraceae	evening primrose	HS	2 or 4	2 or 4	4 or 8	(4)	cap, ber, nutl	hypanthium present, stigmas often 4-lobed
Umbelliferae (Apiaceae)	parsley	H[ST]	5	5	5	(2)	schizo	typically with a compound umbel, stems hollow, lvs compound petioles sheathing at base
Gentianaceae	gentian	H	4	(4-5)	4-5	(2)	cap,ber	lvs opposite, exstipulate, basally connate, glabrous
Asclepiadaceae	milkweed	HSV	5	(5)	5	2	fol	often with milky sap, lvs opposite or whorled, corona and other specialized parts
Apocynaceae	dogbane	HSV	(5)	(5)	5	2	fol, ber, cap	often with milky sap, lvs entire opposite or whorled, carpels free at base, lacking specialized parts of milkweed
Convovulaceae	morning glory	HSV	5	(5)	5	(2)	cap, ber, nut	often with milky sap, twining herbaceous vines in N Hemisphere, corolla plaited
Polemoniaceae	phlox	H	(5)	(5)	5	(3)	cap	flws often funnelform or salverform, stamens often inserted at diff levels, 3 stigmas
Hydrophyllaceae	waterleaf	HS	(5)	(5)	5	(2)	cap	flws usually scorpioid, unilateral, bristly hairy
Boraginaceae	borage	H	5	(5)	5	(2)	nutl, ach, drp	ovary 4-lobed, scorpioid cymes, lvs simple, sessile, alternate, bristly hairy
Verbenaceae	verbena	HST	(5)	(5)z	2+2	(2)	drp, 2or4 nutl	lvs opp or whorled, single terminal style, stem often 4-angled
Labiatae (Lamiaceae)	mint	HS	(5)	(5)z	2 or 2+2	(2)	nutl, drp	ovary 4-lobed, 4-angled stems, style bifid at apex with unequal lobes
Solanaceae	nightshade	HSVT	(5)	(5)	5	(2)	ber, cap	lvs alternate
Scrophulariaceae	figwort	HS	(5)	(5)z	[2] 2+2 [5]	(2)	ber, cap	ovary not 4-lobed, stamens usually didynamous with a sterile filament
Rubiaceae	madder	HST	4-5	(4-5)	4-5	(2)	ber, cap	stipules often leaflike, lvs opposite or whorled
Compositae (Asteraceae)	sunflower	HST	x	(5) or (5)z	5	(2)	ach	inflorescense in heads

Monocots

Family	Common Name	Form	K	C	A	G	Fruit Type	Miscellaneous Comments
Juncaceae	rush	H	3	3	6	(3)	cap	small grass-like herbs, 3-many seeded capsule, perianth scarious, green or brown
Cyperaceae	sedge	H	x	0	3	(2-3)	ach, nutl	grass-like, stems often 3-sided, solid, nodes not apparent
Liliaceae	lily	H	3	3	6[3]	3	cap, ber	fam often expanded to include Yucca and Agave
Agavaceae	agave	HS	3	3	6	(3)	cap, ber	flws subtended by spathelike bracts, lvs persisting in basal rosette
Orchidaceae	orchid	H	3	2+1z	1-2	(3)	cap	lip often elaborate
Gramineae (Poaceae)	grass	H	2-3	0	3	(2-3)	cary	glumes present, stems hollow with obivious nodes

Character Explanation

Form: T=tree, S=shrub, H=herb, V=vine

K=calyx, C=corolla, A=androecium (stamens), G=gynoecium (carpels)

Symbols: ⌒=fused by upper parts, ⌣=fused by lower parts, G=ovary superior, $\overline{G}$=ovary inferior, Cz=corolla irregular, ()=parts united i.e. fused, []=rarely, x=low unstable number, ∞=numerous

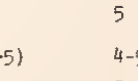
Fruit Types

achene = single seed tightly enclosed by the fruit wall as in sunflower family

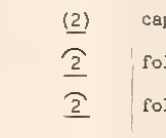
nut = 1-seeded fruit with hard shell

nutlet = a small nut

caryopsis = seed and fruit wall fused

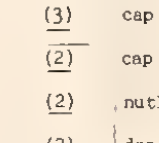


utricle = achene-like with seed loosely surrounded by fruit wall



schizocarp = compound dry fruit splitting into 1-seeded indehiscent segments

capsule = dry dehiscent several to many-seeded fruit of 2 or more carpels

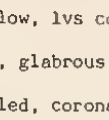


silique = 2-valved capsule where walls peel away from central partition

silicle = silique not more than 2-3 times longer than wide

pyxis = capsule opening by a lid

legume = unicarpellate, dehiscing along both autures



follicle = unicarpellate, dehiscing along one suture

berry = fruit wall (pericarp) fleshy as in a grape

pome = inferior ovary where hypanthium forms fleshy fruit as in apple

drupe = pericarp divided into fleshy exterior and bony interior as in peach

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